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Shall We Build for Quality or for Price?

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AFTER spending his best efforts in sales argument to obtain an order involving certain desirable projects, the pressed metal engineer sometimes reaches the stage where he feels that there is no need to turn to the story of the Tower of Babel for an illustration of the confusion of the tongues. "We simply are not talking the same language," is the present-day expression for the feeling that the other man does not understand, or he would not remain unsold.

In the manufacture and sale of pressed metal parts, the matter of tools and tool charges usually assumes such large proportions as to justify a critical calculation of some of the considerations that arise from the viewpoints of expense and policy to be pursued.

Necessary Accessories

To place ourselves at the outset on the plane of talking the same language, let us consider what is meant by tools in pressed metal negotiations. To say it concisely is to define these tools as the necessary accessories to press equipment which finally make the press ready to produce a specifically designed piece of work. An analogy would be to consider such tools as having the same relative value to the metal press that type has to the printing press. As the printers' type, properly designed, arranged, set and operated, is essential to the printed page, so the tool, or die, is essential to the impression and production of pressed metal conforming to the shape of the die.

The jobbing shop has one consideration in tool construction that the shop operating on its own standard product does not have. There is no question in the case of the latter about who stands the expense if the finished product is not up to standard. It lies wholly within the walls of the home production plant to say with full assurance how much shall be expended on the tools to give them what is required in the way of finished parts, and there is no comeback outside of that particular organization if the money does not buy its intended equivalent.

Considering the average buyer who has not yet been fully sold on the business of purchasing pressed metal, it would be perfectly natural to assume that he will incline to a decision based on competitive selection, and from a comparison of initial costs and general reliability, unless he has been acquainted with the phase of the transaction that places the difference in the actual engineering service that he may receive paramount to first cost. A careful examination into facts pointing to ultimate cost and economy, however, will no doubt lead him to entrust his work to an organization of experts whose sole efforts have been to seek improvements, and who have a background of successful accomplishment.

It is, perhaps, safe to say that competition usually forces the question of what concessions we can make in the tool charge, and where the difference will come from if we make concessions. Can we allow ourselves to base our price on the quotations of others, or shall we hold to our estimate, even if it means the loss of business on which we have a good chance to recover what is lost on an initial order?

How Meet the Question

Assuming that we have quoted on an inquiry involving desirable stamping work, and have been told that our part prices are normal with competition, but that our tool charge is "away out of line," or that by skillful sales effort we learn that the buyer willingly concedes that it would please him to do business with us, but that our competitors, also highly successful operators, are quoting considerably less for tools, how then shall we meet the issue that the business is ours if we will make the tools for so much money?

Sizing up our estimate carefully, we find that we did not arrive at the quoted price by guesswork. Our estimators considered certain kinds and qualities of materials, cast iron for shoes, machine and tool steel in places where they were needed for resistance to stress and wear. They have also considered, based on recorded

experience, the time that it will take to machine, fit and assemble each part; and have estimated very closely on the time necessary for a thorough trial of the tool in the press after completion.

"After all," says the salesman to himself, "an estimate is only experienced guesswork," so he then has recourse to the tool engineer, the press superintendent, and the tool room foreman, and voices the need for some immediate help. Of course, not being handicapped by such a thing as sales resistance, it may be difficult to make them understand the need for a reduction in price, but the request is made, nevertheless, and there would be some characteristic replies after a careful going over of the figures.

"Tell him to go buy 'em somewhere else." "Sure, we'll make 'em for half that, if he will promise not to inspect the parts." "Do they only want ten pieces?" "We got somethin' else to do besides taking a die in and out of the toolroom for fixin'." "Have they all got to be alike?" In these replies from practical men, we have summed up the entire situation. We can assume that it is the desired policy of every contract shop to turn out the best work possible with the facilities at their command, and the inevitable conclusion is that one must provide good tools if he is to expect good work.

Paving the Way for Other Business

So the sales manager departs from the field of shop action. He is convinced that it will cost just about what was quoted to build the tools. With a fair price on them, what have we the right to expect from the best set of the dies that our men know how to build? The features may be summed up as follows: Accuracy of finished parts within limits agreed upon. Uniformity, meaning that the last part of the run will be exactly as the first, and requiring only a minimum of inspection. Dependability, which means that once the tool is set up for production it will not have to be taken out before the run is completed except in unusually heavy and extended production. Long life, meaning that with proper lubrication and care in operation, the parts will not need more than normal repair and renewal. Peace of mind of all concerned with the production and cost, assuring that complaints and adjustments will be few, and that the product sent out will be the company's best advertiser, paving the way for repeat business.

If the sales department decides to take the order and does reduce its price, it may far better contemplate swallowing the loss at the outset, than to build hope on a cheaper set of tools. To cut the corners so that in taking an order of this kind there would be no loss the tools would usually lack the features we have claimed for the best. Tool and machine steel would be sparingly used at points of wear, if at all; accessibility sacrificed in less machine work; guides and pilots omitted in the hope that punches will not break, or dies will not shear. All in all, the tools would be an improvised imitation, and a prolific source of trouble.

The inevitable result must be poor work, exasperated operators, blasé inspectors, complaints, attempts at conciliation, frequent return of materials shipped, and finally a second set properly built if the customer has not become entirely disgusted and had a good set built elsewhere. A manufacturer cannot hope to pass the expense of such work on to the customer and continue in business.

It might be remarked to the purchasing agent that a low tool charge may be a real danger signal that should justify a close-up scrutiny. There may be occasions justifying a low charge for tools, or perhaps no charge at all. In some cases the design is such that a great many stock tools are available in one shop where they are not in another, or the volume of the order is so large that at a nominal margin of profit, the entire expense of tools, when considered in proportion, is so small that it becomes negligible.

But these conditions are entirely sales functions and have no relation to the actual cost of tool building. In any case requiring new and good tools the expense is there, and we are foolish to try to dodge it. There must be enough value apparent when the order is taken to authorize the shop men to build, at a given estimate, the sort of tools on which they will stake their pride, their company's reputation, and the desire of the whole organization to render the sort of service by which it expects to become known.

The tool charge in itself, and in its various handlings, has become one of the most difficult considerations confronting the pressed metal manufacturer doing contract work, and has in many cases amounted to an evil because of abuses and misunderstandings. Properly considered, the assumption of a contract to make certain parts, and the building of a set of tools, is investing money in the business. If it is your own business, you will build as well as your judgment dictates and your treasury allows, expecting to pay for it out of the profits of the finished product.

Assuring a Profit

Equipping a shop to do work for another must include the provision that it will in time get back the investment plus a profit. It may be asked at this point why this tool charge is not pro-rated over whatever number of parts are ordered. That is fair procedure, but it makes the part price higher, and naturally puts it far up if quantities are small. The stamper cannot put in his money without reasonable surety of return on it, yet we find buyers staggered at the mention of a tool charge, who would be more staggered if we ventured to quote a part price in which the tool costs had been absorbed.

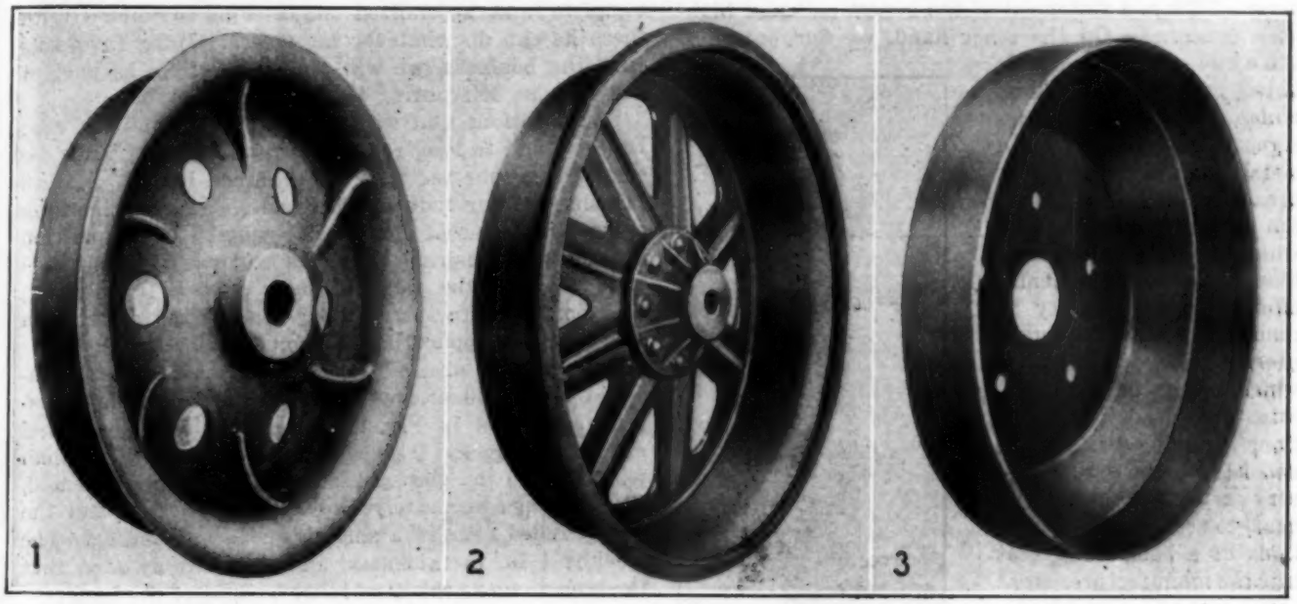
The much discussed ownership provision injects itself at this point. Nobody likes to pay for something he does not get, and the buyer often assures himself and the pressed metal salesman: "Since I pay for these tools, of course I own them and can remove my property from your plant if I wish." This would be a proper thought if the idea of a physical asset only is represented by the tool charge. The term is not more universally understood usually because the salesman has been so eager to get an order that he has not taken the time to make the matter clear, or else it is not clear in his own mind, or because he obscures it.

If a set of dies is to be the physical asset of the party contracting for the parts, these provisions should apply: 1. He should design and have the tools built himself, making sure that the design is such that they will fit and operate successfully in the presses of the shop where he places business. 2. He will agree to assume the expense of necessary repairs, replacement of worn parts, and up-keep, such as polishing and grinding. If the owner is not accustomed to operating dies in his own presses, it is a difficult matter to have him under-

stand this point. It is a fact that the average person, not familiar with press processes, regards dies as tools that operate without more attention than to feed in the blanks and provide a little lubricant. 3. He must protect his interest by covering this asset with insurance. If these requirements are met there can be no question raised regarding the ownership or privilege of removal. In such a case they are truly his property, designed by him, protected and kept in shape at his expense, and representing a distinct investment in a complete equipment, with the exception of the press.

It cannot possibly be considered a parallel case when the tool charge represents engineering skill in design and experience brought to bear on the buyer's specific problem, and that it also represents that portion of the expense of additional tool construction without which the shop could not produce the part wanted.

One answer to the question whether or not the buyer should be allowed to remove the actual part he pays for, is that even a whole set of dies, conceived and built in one shop, will rarely be worth anything in another. Ideas of construction differ so widely, that practice successfully prosecuted in the one would be scoffed at in the other, although in all probability equal results



Figs. 1, 2—Cast-iron wheel weighing 125 lb. replaced by a 47-lb. pressed steel wheel.
Fig. 3—Pressed steel brake drum

the buyer pays a nominal tool charge, and the term is not intended to mean the same thing. The buyer does not always understand what is involved in the expense of tooling up, and furthermore, competition has forced tool charges down to a ridiculous portion of the amount in dollars and cents of the actual initial cost of constructing the tools to do the work called for by the contract. If every stamping manufacturer were suddenly called upon to surrender each set of tools in his shop, at a price per set equaling the tool charge made when they were built, it is probable that most of them would be on the verge of bankruptcy through direct losses where contracts were not yet complete, or through lowering of their own assets as shown on the balance sheet.

To meet the competition successfully, stock tools, such as blanking dies, and forming and drawing dies up to the point of final form, are used whenever possible. This obviates the necessity of duplication, and such tools, being stock equipment, cannot properly be included in the tool charge, except possibly a small differential for up-keep. Under such circumstances, the buyer cannot possibly conceive that he has paid for all of the special tools which were used to make his product, any more than he pays outright for more than the use of presses, stripper, hold downs, bolsters and spring pressure arrangements common for every press shop.

Every point of view discussed to any length will inevitably lead back to the same conclusions, namely, that would be obtained, were each left to individual methods of procedure. Some dies can be moved around between shops, but in general it is best to discourage the practice, if only from the viewpoint of the expense attendant on adaptation to differing equipment and experience in operating.

Buyers frequently insist upon such a removability, or ownership, clause in the contract. If it is for protection in case of fire, strikes, or the like, we believe that it may be dismissed at once with the statement that it is never safe to make any sort of contract with any but reliable concerns, manned by executives of character and moral responsibility. If it is to hold a club over the head of the contracting manufacturers, let us say at once that if we cannot embark upon a contract with entire confidence, we might better lose the business.

It may be that the buyer assumes that prices may go up after the first order. There may be reason for a price advance, but on such occasions it can usually be explained and appreciated. However, this rarely happens with reliable concerns who know their business. If buyers are fair-minded, it can generally be shown that initial prices are more often reduced, on an equal basis of raw material, and provided that quantity runs give opportunity for accelerated production. It is usually the cut-throat estimator who later finds it necessary to raise prices, and there is no competition so much feared, or more to be guarded against by the buyer, as that class which does not know and is guessing at costs.

The tool expense rightfully belongs to the party for whom the parts are designed and made. We can ascertain with reasonable certainty how much it will be, and if we are honest in our purpose to turn out the best work possible, we shall place it there, build the best we know how, and tell the buyer what is represented. There may be special considerations, but this rule is intended to deal with the general run of work in the average contract shop specializing in pressed metal.

No reputable stamping concern uses special tools except for the customer who pays the tool charge, unless express permission is given and equitable arrangement made. This is a statement of the honest policy of high-class concerns. On the other hand, we find occasions where an unscrupulous buyer, contrary to business ethics, has made use of designs offered by a pressed metal engineer, to copy, broadcast and even make the offering a club with which he proceeds to swat him. We are frequently offered an opportunity to render a specialized engineering service gratis, which brings us to a delicate and debatable question, involving both moral and legal claims. This very disposition to serve is made to assume the proportions of a boomerang that hits the manufacturer right between the eyes, and leaves him conscious of an inflicted wound, and the immediate reaction is to set up measures to provide against further recurrence.

Fig. 4—Pressed steel pump housing

This boomerang works in this way: You have seen where your process will work to splendid advantage in some man's scheme and are cordially invited to explain; you explain your idea in a general way, but enough to allow him to glimpse economies that he has never thought of, and thereby create an interest and a hunger for the details. Sizing up the man and his business as one of integrity and fairness, you produce a set of drawings and present them to him for consideration, with the reasonable expectancy of receiving his business, now that you have demonstrated a manufacturing economy to him.

After you have gone, he or his associates get the idea that they can get a cheaper price, so they copy and broadcast to your competitors for their quotation. If the original idea is novel, there is a great possibility that the quotation will be "out of line," because it bears all the expense of consulting engineering service, which the others do not.

We have to take such treatment with a grin, of course, at least openly. There will be those who will remark that we should have had the idea patented, copyrighted, or have made a contract in the first place. There will be a second group who will say that a customer who will do that is not desirable anyway. Unfortunately, he is usually very desirable or we would not have spent so much time on him. A third will say that if we cannot meet competition, we are not entitled to the business. But there is no competition so much feared as that of hasty estimating and willingness to secure first orders at any expense.

It may be that the loss in engineering service is sales effort lost in playing for the stake of a desirable order. But we believe that it is better business at the point where details are asked for, to explain that up to this point we have given freely of our engineering brains and experience, but that we expect to profit from the undertaking and request that he agree to obligate himself for consulting service, in which we will give complete and specialized engineering details. With these he can do whatever he wishes. If he favors us with the business, we will absorb the item as part of our expense of securing the order.

The questions that we must answer in this case are: Do we stand to lose, or win, in the long run? Are we establishing our service on a dignified basis? Are we translating our advertising, sales, and engineering effort into terms of commercial value? Is competition so keen that desirable business will pass to engineers who minimize the value of their services? In short, are some manufacturers today placing the dollar sign above honest application of commercial ethics?

Examples of pressed steel parts that require expensive tools are illustrated in Figs. 2 and 3. The industrial car wheel in Fig. 2 replaces the cast-iron wheel shown in Fig. 1. It must be concentric with the hub within 0.030 in., the spokes must be sharply indented, the openings accurately and sharply pierced, and the flange rolled over in a smooth and even contour. The steel is ¼ in. in thickness, and it is readily seen that the tools to make this part must be built of the best.

The brake drum shown in Fig. 3 is made of 0.30 to 0.35 per cent carbon steel. It must not vary more than 0.015 in. from a true circle, and the hub and bolt holes must be centered exactly. Moreover, the braking surface should require no machining. Nothing short of a first-class set of tools on which no expense is spared and no materials skimped will be required to turn out this part continuously and accurately.

Another excellent example of press work is the gasoline pump housing shown in Fig. 4. To the casual eye the formed surfaces may be free from wrinkles, but when a coat of enamel paint is applied the shadows will appear if it is not perfectly formed. It requires the best in tool building and careful tool engineering to make a product that will stand this test.

In initial stages and during experimental work, the finished blueprint, or model, often does not convey the entire impression and carry conviction that the die-made part will be exactly what is wanted. It is perhaps the best in a case of this kind to make the dies entirely of cast iron where the best tool steel must be used later in production, but this should be done in such a way that tool steel can be included later.

Tools that are not constructed to a purpose, but are "built to a price," will bring nothing but trouble. As engineers, it is the obligation of the pressed metal manufacturer to inform the buyer, whom he seeks to interest in his product, about this vital consideration. If he tells the story sincerely and with entire confidence, he ought to be more whole-heartedly intrusted with high-grade work, in perfect assurance that the impression of quality production will remain long after the price of the tools has been forgotten.

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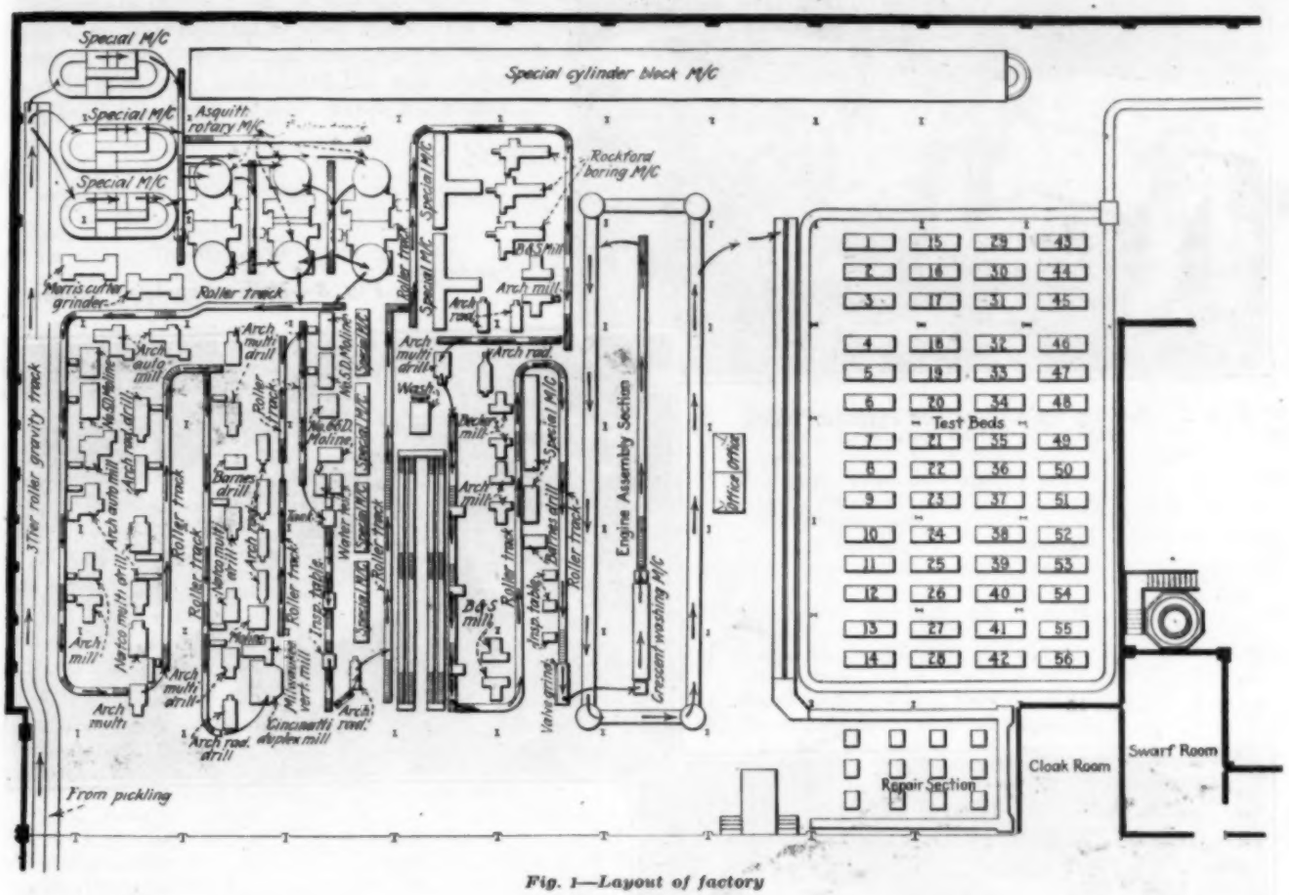

Fig. 1—Layout of factory

Machining the Morris Cylinder Block

By I. William Chubb
Editor, European Edition, American Machinist

THE 4-cylinder Morris motor car is assembled at Cowley, Oxford, but the engine units are manufactured at the Engines Branch of Morris Motors (1926), Ltd., its works at Coventry, the present production being 1,500 units per week of 80 hours.

For machining the cylinder blocks there are two lines, one entirely special, and the other, while embodying the more important principles of the special line, is composed mainly of standard machines adapted for special operations. It is supplemented, however, by a number of machines, recently installed, which were designed by Morris Engines to suit its requirements.

The first article. The second will appear in an early issue.

Though the engines manufactured are for two sizes of pleasure cars and for the Morris commercial vehicle, they are all essentially of the same type, so that, for instance, of the pleasure cars the differences between the Morris-Oxford and the Morris-Cowley engines are that the former has a bore of 75 mm. as against 69.5 mm., and that duralumin connecting rods are employed instead of steel. All dimensions are metric, and the general thickness of metal on the block is 4.5 millimeters.

The castings are brought from the foundry to a receiving station, where they are taken from the tailboards of lorries and elevated mechanically, to the top of a

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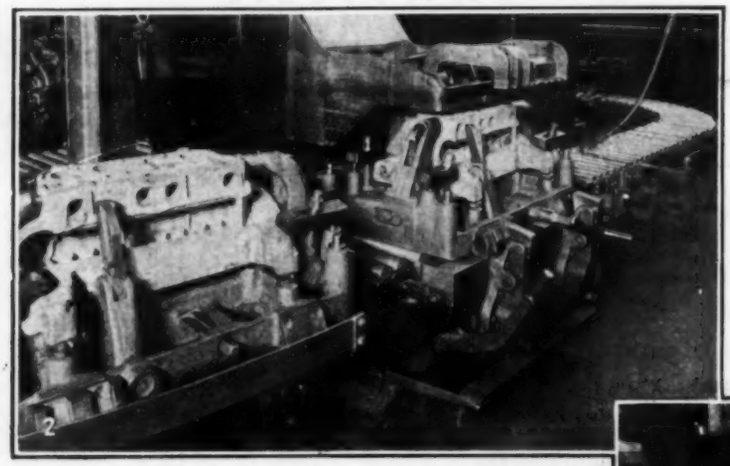
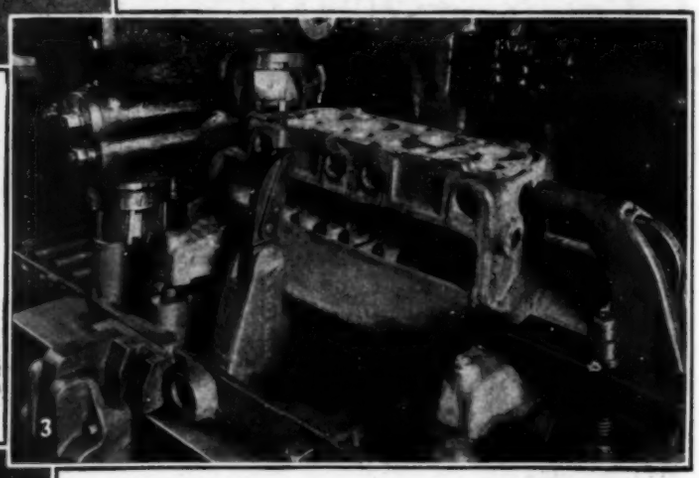


Fig. 2—Setting-up fixture for cylinder block

Fig. 3—Milling spotting points



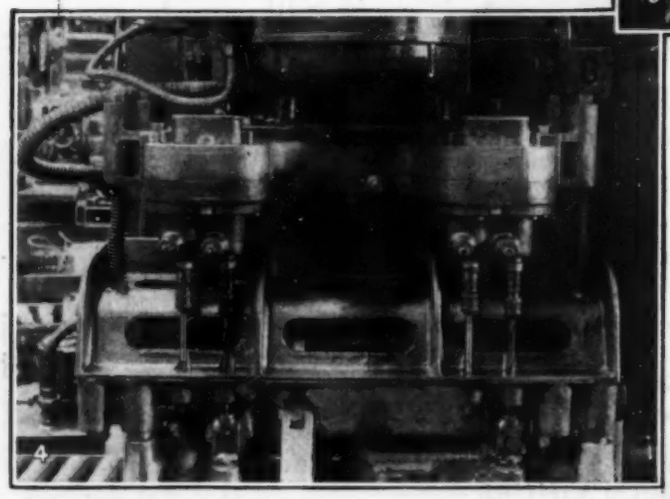
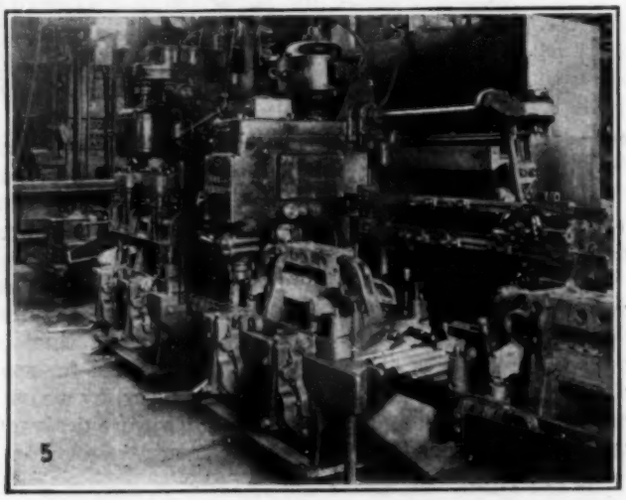


Fig. 4—Drilling and reaming arm holes

Fig. 5—General view first 3 machines' operations



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lofty steel structure, from which they descend by gravity over a roller conveyor of helical form, the whole installation constituting a storage system which saves a considerable amount of floor space. By conveyor they pass to a pickling solution consisting of dilute sulphuric and hydrofluoric acids. On the way, roll-over fixtures are built into the conveyor, where the blocks are dressed as may be necessary. They are passed through the pickling tank on a circular wheel about 24 ft. in diameter, the periphery of which rotates at the rate of about 6 in. per min. They are then lifted and passed successively through cold water and a solution of soda, the blocks then being placed on one or other of the roller tracks leading to the position for machining operations.

Sequence of Operations

Oper. Number	Description of Operation	Machine	Floor to Floor Time Min.
1	Chip and pickle	.....	...
2	Hose and soda wash	.....	...
3	Set up	Special	1–30
4	Mill spottings	Special	1–30
5	Drill and ream arm holes	Special	2–30
..	Remove from fixture	.....	....
6	Mill bottom face	Asquith rotary mill	12–00
7	Mill top face, also face of cylinder head	Asquith rotary mill	....
8	Mill side face	2-Archdale auto. hor. mills	5–00
9	Rough cylinder bore	2-5D Molines	4–30
10	Mill gearbox face, Camshaft- and water-joint face	2-Archdale duplex auto. mills	5–00
11	Mill carburetter- and steering-column face	1–28-in. Archdale horizontal mill with 6-sp. attachment	2–00
12	Mill mag. platform and acc. face	1–4B. B. & S. hor. mill with sp. vert. attachment	2–00
13	Drill and ream valve-guide holes	16-spindle Archdale	3–00
14	Bore valve throats	8-sp. Natco	1–30
15	Drill top	Natco	1–30
16	Drill and tap 2-holes water flange 2-holes c/ shaft ft. cover	Radial	2–00
17	Tap top	Morris special multi-spindle machine	1–00
18	Drill, face and tap 35-mm. breather hole	Barnes drill	2–00
19	Drill and ream tappet holes	16-sp. Archdale	3–00
20	Spot face tappet holes	8-sp. Natco	1–00
21	Drill bottom and oil holes	1-Natco	2–45
22	Drill bearing-block stud holes	12-spindle Archdale	1–45
23	Drill and ream bearing dowel-holes	12-spindle Archdale	1–15
24	Tap sump holes and bearing-block holes	Morris special multi-spindle	1–30
25	Mill sides of bearing-block faces and camshaft boss	Cincinnati duplex	2–45
26	Chamfer cylinder bore	5-D Molines	1–00
27	Drill two holes to mag. shaft	Radial	1–30
28	Drill two angular oil holes	Radial	1–30
29	Drill exhaust side-plate holes	Natco	1–45
30	Tap exhaust and side-plate holes	Morris special multi-tapper	1–00
31	Drill carb. and steering-column holes	Radial	1–00
32	Nil	.....	....
33	Tap carb, etc., holes	Special	1–00
34	Finish cylinder bore	2-Molines Hole Hog.	6–30
35	Mill connecting rod clearance	5D Molines	2–30
36	Roll cylinder bore	5D Molines	1–30
37	Water test	.....	....
38	Inspect	.....	....
39	Drill and counterbore water-plug holes, oil cock hole	Heavy Radial	2–30
40	Tap bearing stud-holes	Morris special	1–00
41	Assemble blocks and drive studs	Air Motor	3–00
42	Bolt down caps, nuts and two carburetor nuts. Drive home studs	Hand	3–00
43	Core drill cam bore	Special	2–45
44	Drill, strip and face mag. bore	Special	2–45
45	Rough bore and face cam bore	Special	2–45
46	Rough bore, recess and face mag. bore	Special	2–30
47	Finish back face mag. bore	.....	....
48	Finish bore cam and crank bores. Finish bore and face mag. bore	Special	6–30
49	Inspect	.....	....
50	Face cam bore	3-Rockford boring machines	2–30
51	Face front-bearing blocks to width	.....	3–00
52	Finish recess and back face mag. bore. Press in bush. Face both ends of mag.-shaft bush. Ream bush in position	.....	3–00
53	Mill cam-wheel clearance	1–28–Archdale hor. milling machine	2–15
54	Drill flywheel end and camshaft cover	Archdale multi	1–45
55	Tap gearbox and c/shaft cover holes	Morris special	1–00
56	Spot face valve-guide hole. Drill mag.-shaft drain holes. Drill name-plate hole	Radial	1–00
57	Broach tappet holes. Press in valve guides and broach	2-Lucas presses	2–00
58	Soda wash	Washing machine	3–00
59	Inspect and fettle	.....	....
60	Fit and mill liners flush with bearing block	2-Becker vertical	2–45
61	Fit and mill liners flush with bearing caps	2-Archdale vertical mills	2 45
62	Bolt on caps with shims as required	Hand	3–00
63	Ream white-metal and face front liners	Morris special	3–00
64	Broach bearing liners	Morris special	1–15
65	Cut valve seats	Barnes	1–45
66	Inspect	.....	....
67	Grind valve seats	Hand	3–00
68	Final wash	Crescent washing machine	3–00

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The complete shop layout for this line is shown in Fig. 1, and the operation sheet as far as it concerns this article is here given. The roller conveyors are at working height all round and have many points of interest, including their movable gates.

For the third operation—the first in the machine shop—the block is set up in a fixture (see Fig. 2) by means of plungers for the ends and sides and also for the bottom of the casting, with a gage on top which sets for the machining allowance. The setting fixture is brought by the roller track to the top face of a fixed bracket, the track then being lowered by pressure on the treadle shown. The hand lever then operates the links at the front, pressing the fixture back against an abutment and also locating it lengthwise by forcing the ends of the levers into engagement with slots. The setting gage is carried on a bracket over the block and swings down into position, being balanced by a weight on an arm.

The block then passes by conveyor to a Morris-made special machine, Fig. 3, where the four arm bosses and four spotting points on the top are milled, an 8-in. left-hand mill being employed for the four spots on top and one 4½-in. cutter at the back and one at the front of the arm. At this machine a treadle is employed to lift the roller track, since the block and fixture together are too heavy to be pushed by hand across the solid seating on which they rest. Quick motion is provided for the milling head between the spotting faces. At the next stage (Fig. 4) four holes are drilled and reamed in the arms, and these arm holes and the spotting faces are the locating points for all the remaining operations. Fig. 5 illustrates the machines employed in these operations.

From this position the blocks are taken out of the fixtures and are placed onto the roller track, in order that a series of milling operations may be performed by special Morris-designed vertical mills. These machines, with overhead runways and roller track, and the operation is shown in some detail in Fig. 6. The blocks, to the number of six, are carried on a rotating table in order that the bottom faces may be machined. About ¼ in. is taken off. The rotary table provides ample space for loading and unloading. The faces on the arms are the locating points, the supporting plungers being spring-loaded so that the arms will not be broken under the thrust of the cut. One arm on each side is clamped between a pivoted abutment and a screw.

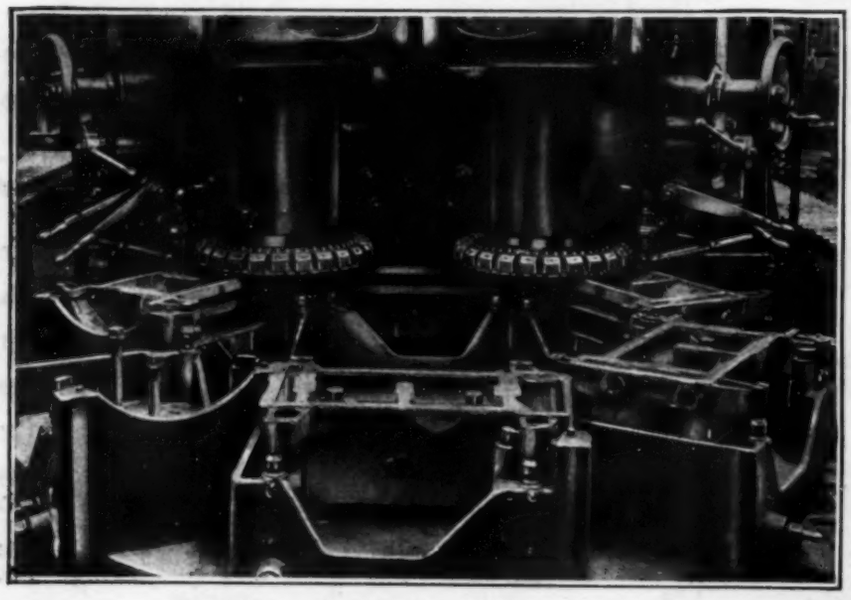


Fig. 6—Milling the cylinder blocks

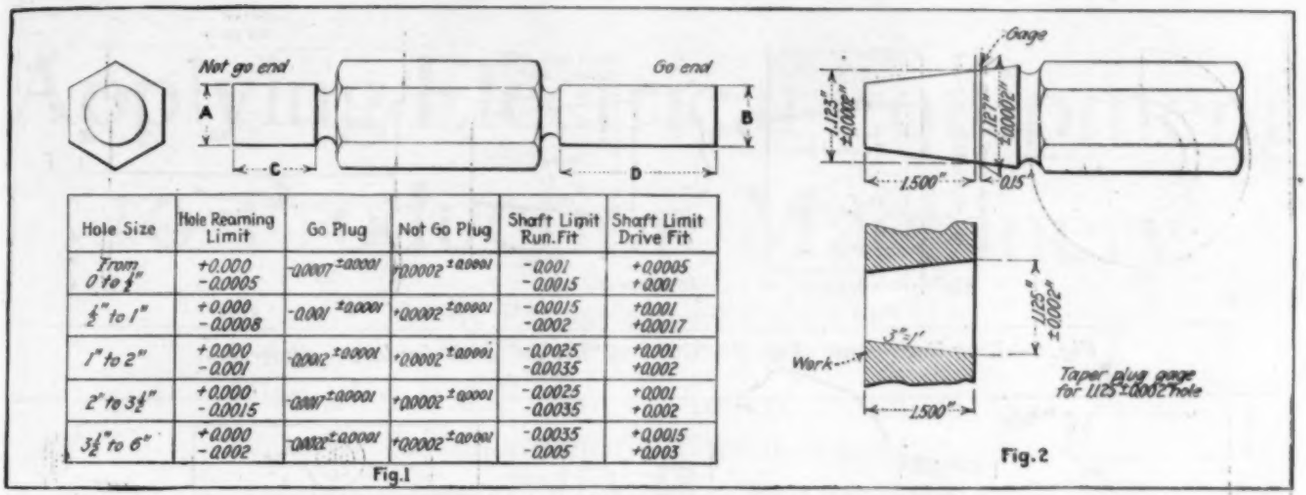
Tractor Cylinder-Grinding Experiences

By William Exline

JOHN R. GODFREY'S interesting talk on cylinder bores reminds us of our 15-year experience in this line. We began by boring cylinders in a lathe and lapping them with a split piston. Then we bought a special boring machine that seemed to do a better job than the lathe. By using a hone, and we tried three different kinds, we got what looked like a good job. We used this outfit for three years, finishing about 200 cylinders a year. But we were not satisfied as they did not stand up as they should.

Next came a cylinder grinder, but still we felt that there was distortion, due both to the heat of grinding and of the cylinder when in use. Even this machine was not quite satisfactory and so, after a long study, we bought a wet grinder, larger and heavier than the first, and ground the cylinders wet. We tested the value of this method by grinding a cylinder dry until it became as hot as on the first grinder. Then we dressed the wheel and took a light cut, and as Mr. Godfrey said, it only touched in spots, showing the distortion. The use of water seems to put a glazed surface on the cylinder wall and leaves no marks.

One trouble with boring and reaming is that by the time the cylinder is worn smooth, the rings are worn out. If we put new rings in the old piston, there was so much clearance that it would pump oil. We tested two tractors, boring and honing the cylinders of one and wet-grinding those of the other, putting both at work in the same field. The pistons in the honed-cylinder job seized before the tractor got half way around the field, and it took half a day's nursing to get it to running right. The tractor with the wet-ground cylinders gave no trouble. After ten days we took both engines down. The bored and honed job had worn 0.018 in. and was tapered. The other had not worn over 0.001 in. Pistons for both had been ground with a clearance of 0.001 in. per in. of diameter. When cylinders have to be enlarged over 0.062 in. we first bore and leave 0.01 in. for grinding. This is much more than need be allowed if the boring machine would bore a hole straight or round, but it varies over 0.002 in. out of round, and the tool seems to spring.



Hole Size	Hole Reaming Limit	Go Plug	Not Go Plug	Shaft Limit Run. Fit	Shaft Limit Drive Fit
From 0 to ½"	+0.000 −0.0005	−0.0007 ±0.0001	+0.0002 ±0.0001	−0.001 −0.0015	+0.0005 +0.001
½" to 1"	+0.000 −0.0008	−0.001 ±0.0001	+0.0002 ±0.0001	−0.0015 −0.002	+0.001 +0.0017
1" to 2"	+0.000 −0.001	−0.002 ±0.0001	+0.0002 ±0.0001	−0.0025 −0.0035	+0.001 +0.002
2" to 3½"	+0.000 −0.0015	−0.0017 ±0.0001	+0.0002 ±0.0001	−0.0025 −0.0035	+0.001 +0.002
3½" to 6"	+0.000 −0.002	−0.002 ±0.0001	+0.0002 ±0.0001	−0.0035 −0.005	+0.0015 +0.003

Fig. 1

Fig. 2

Fig. 1—"Go" and "not go" plug gage. Fig. 2—Taper plug limit-gage

Limit Gages

their use and application

By M. E. HAROLD

IN THIS age of modern manufacturing, the limit gage system has become one of the main factors in production. There are, however, some manufacturing plants that have not as yet been the advantages of the limit gage system, hence the examples shown herewith.

What may be called a standard plug gage is shown in Fig. 1. It enables the production of duplicate holes within the tolerance given. I have always found it a good practice to make the "Go" end long enough to project through the entire length of hole, plus about ½ in. where possible. The "Not-go" end need not be over 1 in. long for any hole. When checking a long hole with a short "go" end, the hole may be a trifle small in the center and the gage is not long enough to show up the error. With Fig. 1 is a table to be used with this type of gage. The table gives the hole size, reaming limit, size of plug on both ends, the limit for shafts, both running fit and drive fit. The ends are plainly marked. This makes an inexpensive gage, being made from commercial hex stock. In Fig. 2 is a taper, plug limit-gage, also a cross-section of the work to be checked. The hole in the work is tapered 3 in. in 1 ft. and the large end must be 1.125 ± 0.002 in. diameter. The gage has two lines on its diameter, one marked 1.123 ± 0.002 and the other 1.127 ± 0.002. The hole is finished so that the gage will enter to, or beyond the 1.123 line but not beyond the 1.127 line. Then the hole will be within the limits of 1.125 ± 0.002 in. This gage is also made of hex stock.

In Fig. 3 is a limit ring-gage, and the work gages. The work is rough turned to fit the 1.147 line on the gage, and is then ground to fit the 1.125 line. The gage has one-quarter cut away so that the 1.125 line is plainly seen. A limit gage for use on large-diameter holes is shown in Fig. 4 this particular gage being for a 3-in. hole. The dimension *X* can be made to suit any depth of hole. Fig. 5 shows a limit gage for checking a hole 1 in. deep. The 0.997-in. end should be below the outer surface of hole, and the 1.003-in. end above it.

Another type of limit gage is shown in Fig. 6. It is used for squaring up work or to get the exact distance through a hole. The gage is for a piece of work which must be 1⅛ in. thick. In Fig. 7 is a gage for grooved pulleys, etc., where duplication is required. In Fig. 8 is a cap in cross-section. The cap is bored a certain depth for a seat. The outside must also seat to correspond with the inside. The limit gage shown was made, allowing a variation of 0.002 in. That is, one outside point of the gage was made 0.002 in. longer than the other point. The gage is moved from one side to the other, and if the work is correct, one end will go over, and the other end will not. A worm and bracket are shown in Fig. 9. The worm must fit in the bracket with no end motion. The parts were checked with the two limit gages shown at *A* and *B*. Gage *A* was used when machining the bracket, while gage *B* was used when facing the worm to length. These gages have eliminated the fitting formerly required, saving the small gage cost many times over. In Fig. 10 is a limit depth-gage, for a chamber bored in a bowl where a given distance is desired from a finished surface on top to a finished surface in the bottom. The bottom must be a $3.500\ \frac{+0.002}{-0.000}$ in. from the top, as shown. The gage is shown in position on the bowl, and a detail of the gage pin is also shown. The gage is set on top of the bowl and the gage pin is pushed down until the top is flush

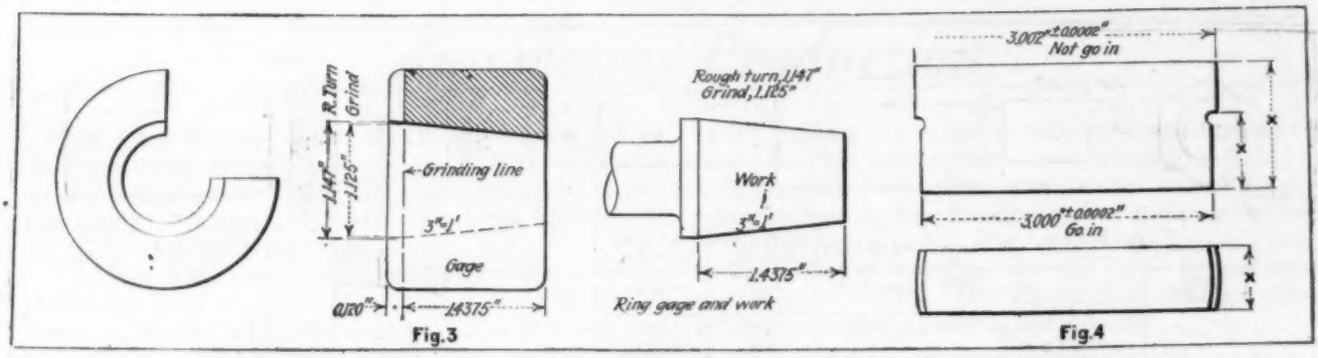


Fig. 3—Ring limit-gage. Fig. 4—"Go" and "not go" gage for larger diameters

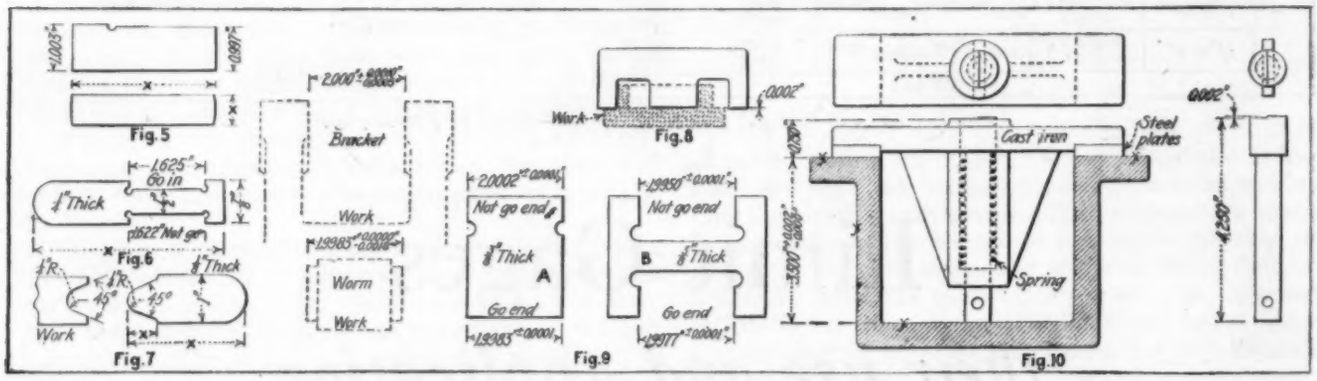


Fig. 5—Limit gage for checking depth of hole. Fig. 6—Limit gage for through distance of hole Fig. 7—Gage for grooved pulley. Fig. 8—Gage for cap. Fig. 9—Gages for worm and bracket. Fig. 10—Limit gage of flush-pin type

with the top of the gage. This refers to either lip on top of the gage pin, or in other words the 4.250-in. dimension of pin must never be above the surface of the gage, or the 0.002-in. limit part below the surface. This gage costs very little since it has a cast-iron body, with hardened steel plates held by screws not shown.

American Machine Tools in British Shops

BY F. P. TERRY

Belfast, Ireland

WHEN considering the purchase of equipment for the machine shop, the slogan "Buy British Goods" crops up, and whether this slogan should have precedence or be ignored entirely as far as American machine tools are concerned must be decided, the latter view being, I think, the most popular one, due to the fact that the machine tool business of both countries has been built up to a very large extent in combination, to the mutual benefit of all concerned, and to attempt the introduction of a dividing line would benefit no one.

Several of our most useful tools have originated in Britain, while the perfecting and general use has been brought about in the United States. That the vertical boring mill was first made in Manchester and condemned as a failure, to be later brought to the front in America, is only one instance of several of this sort. We have also to bear in mind that several American machine tools, beyond the fact of being made there, have very little else American in their make-up. The brains and enthusiasm necessary have been British throughout.

One well-known American engine lathe, very hard to excel, owes its birth to a Leeds man who found his opportunity of doing something for machine shops in general, and for his own country in particular. Quite recently a British machine tool maker, although very strong on the point of buying British goods as far as his own products were concerned, admitted to me that he had American machine tools in use in his own works, but not, of course, for operations similar to his own production. When I pointed out that these tools were at least competing with other British toolmakers, he failed to catch my point.

Some British toolmakers go further and are also handling American machine tools, not in competition with their own products, as a sort of side line, which further complicates matters for the prospective purchaser. We are advised by real patriots on every hand, that to regain our industrial markets, we must adopt American methods all around, with labor, tools, appliances and methods. This appears rather contradictory if we are not to include American machine tools where advantageous. Consequently we can only conclude that the slogan "Buy British Goods" cannot, and does not, apply to American machine tools, but to the production obtained from them, and, which to be effective, must be the best and cheapest production of its kind. Undoubtedly the competition of American machine tools during the past thirty years has done much to improve the home product, and their continuous use will still have this effect. While giving due regard to the home product, the real live man cannot ignore American machine tools if higest production is the desired end, for without them, American methods cannot be followed throughout.

Applying Electrical Equipment to Production Machinery

By Robert Corey Deale
Electrical Engineer, Niles-Bement-Pond Co.

Discussion of d.c. drum controllers, continued—Various types of full-automatic controllers for d.c. motors explained—Operation of the vibrating field relay

A SECOND type of drum controller starts the motor with resistance in series with the armature that is gradually cut out of circuit to bring the motor to running speed. The motor may be run with part or all of the resistance in series, if the resistor is designed for that service. The reduced speed thus obtained varies with the load and consequently is not desirable for machine tool service. Drum controllers of this type are used for operating motors used on machines having all speed changes obtained through gear changes, or the larger sizes of traverse motors, and are used very generally for controlling the motors of cranes and hoists. When so used, they usually provide dynamic braking contacts in the "off" position, and they may provide for shunting the armature of the hoist motor while the crane hook is being lowered. This construction is used to prevent the motor from running too rapidly while it is lightly loaded, or while the load on the hook tends to operate the motor as a generator. Fig. 57 shows a drum controller of this type for controlling the constant-speed d.c. motor driving a gear shaper. The third type of drum controller is used with adjustable-speed d.c. motors. Its contacts are so arranged that the motor is started with resistance in series with the armature, and with full field. A typical controller of this class is shown in Figs. 58 and 59. As the drum handle is thrown to the running position, the armature resistance is gradually cut out of circuit, the field strength in the meantime being maintained at a maximum. When the armature is connected to the line, resistance is gradually introduced in the field circuit of the motor to increase the speed. The motor speed may be increased to a maximum of four times the minimum or normal speed. Field weakening motors have been built with a speed regulation of six to one, but they have not proved completely satisfactory, and consequently are rarely offered. Such a controller may be used to bring the motor up to some desired speed and allow it to run at that speed. The speeds available range between the basic, or full-field speed of the motor, and the maximum speed, obtained by inserting the entire field rheostat in the motor field circuit. Of course, this maximum speed must not be higher than that for which the motor has been designed. Standard controllers usually give a maximum speed of two, three, or four times the minimum or full-field speed. Controllers of this type are usually arranged so that dynamic braking may be applied, if desired, by the addition of an additional resistor. In Fig. 59 the internal construction of a drum of this sort is shown quite clearly. The nine fingers at the lower part of the drum are used to change the amount of resistance in series with the shunt field, and consequently the motor speed, while those at the upper part of the drum, which are well protected by insulating barriers, make and break the armature connections. Fig. 60 shows the field resistance, which is usually mounted on the back of the drum with the leads brought up to the contact fingers through the bottom of the case. The starting and dynamic-braking resistors, which must be mounted separately, are usually made up of grids mounted in frames with ventilated covers.

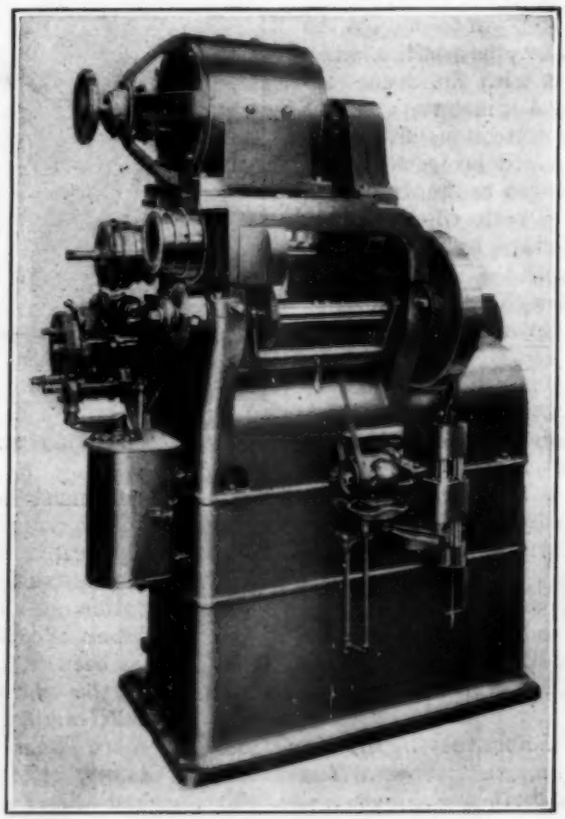
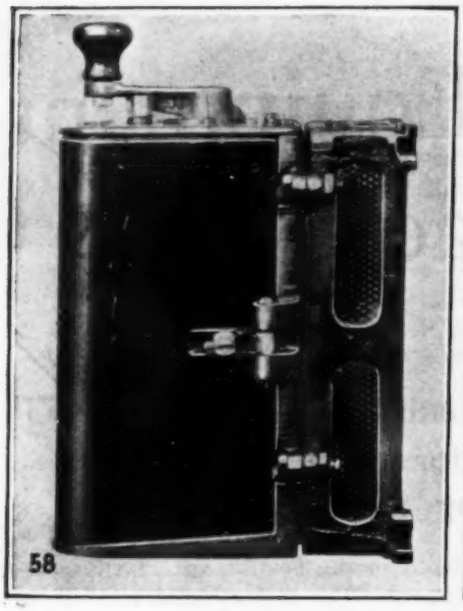


Fig. 57—Drum controller on a gear shaper

The seventh article. The eighth will appear in an early issue.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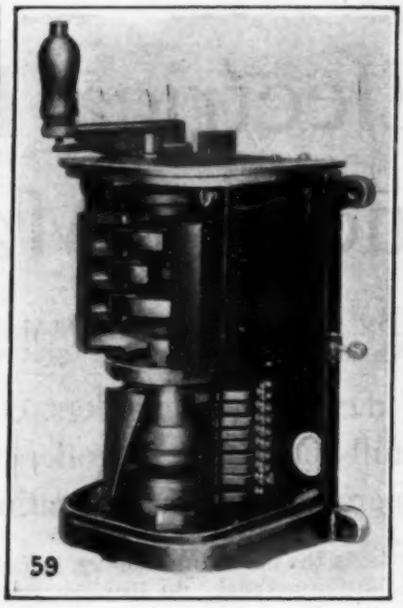
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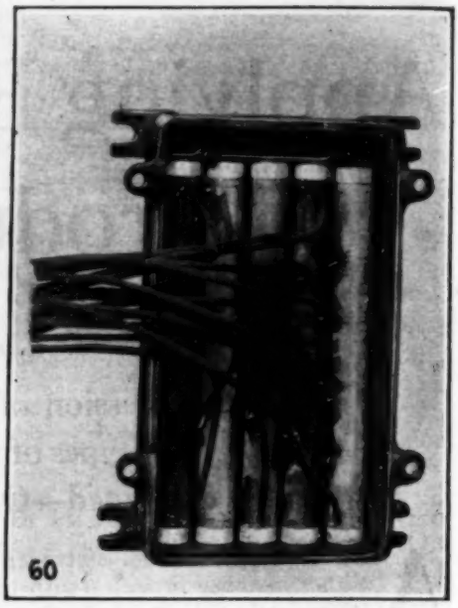
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Fig. 58—Drum controller with starting and field resistances attached for use with adjustable-speed d.c. motors
Fig. 59—Interior view showing construction. Fig. 60—Starting and field resistance units

Most d.c. drum controllers are designed for reversing service, and are provided with a stop pin to prevent the drum from being thrown to the reverse position when they are used non-reversing. As with the drum controllers used with constant-speed d.c. motors, a circuit breaker providing undervoltage protection, or protective panel is necessary. A standard protective panel is best as it usually may be so wired to the drum controller that the contactors may be restored, after they have opened because of voltage failure, by throwing the drum to neutral. On most panels the overload relay must be reset manually, and after this has been done, the contactor can be closed by throwing the drum to its neutral position.

The same protection may be obtained by the use of an overload and undervoltage circuit breaker. However, the contacts must be manually re-closed, and there is nothing to prevent the circuit breaker from being closed while the drum controller is in the running position. Should this be done, the motor will start directly on the line with a very heavy current inrush, and the circuit breaker will again open. In most cases little or no damage results, but the operator is required to walk back to the drum controller and throw it to neutral, re-close the circuit breaker, and then go back to the drum controller, which is operated to start up the motor in the usual way.

Automatic controllers for d.c. motors may be divided into the full-magnetic and semi-magnetic types. The first type has all basic functions performed by electromagnets, while a semi-magnetic controller has part of its basic functions performed by electromagnets, and part by some other means. By basic function is usually meant line closing, reversing, acceleration and retardation.

The automatic controllers used to control motors on machine tools fall into both these classes, although there seems to be a tendency toward the full-magnetic type. Two prominent manufacturers use the semi-magnetic type of controller extensively, one uses it occasionally, while the largest electrical manufacturer uses the full-magnetic type exclusively. When automatic controllers

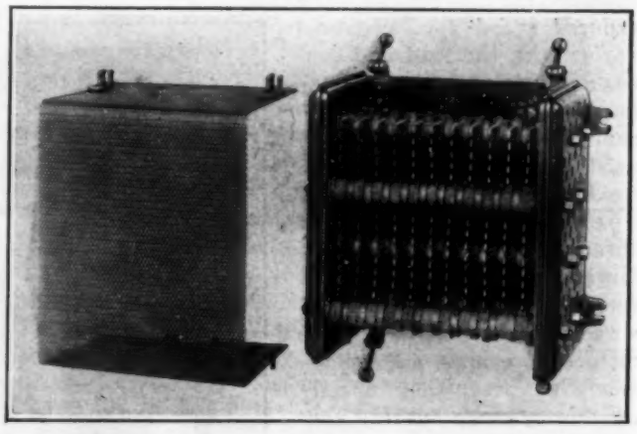


Fig. 61—Starting and dynamic-braking resistors

are used, care must be taken that the controller is suited for the work it has to do, not only electrically, but also mechanically. The standard lines of controllers carried by the electrical manufacturers are intended for normal operation only, and usually fifty cycles a day is a large number of operations under ordinary conditions. It has been claimed that a good automatic controller should be capable of starting and stopping a motor one-half million times before it is worn out. Probably there would be several replacements of contacts, shunts, and other similar parts before the controller had this number of operations. However, under ordinary conditions, one-half million starts would require a number of years.

But on special equipment, such as controllers for reversing motors for planers, or similar service, in which the motor may make a million or more starts in a single year, it is evident that the contactors must have unusual ruggedness, and the resistors must have high thermal capacity or very high radiating capacity in order to handle the power absorbed both in starting and braking. A standard controller used on such service would give continual trouble and should never be so used.

The simplest full-automatic controller is that having but one line contactor, which is closed to start a motor and opened to stop it. This type of controller is little used, as it is satisfactory only for small d.c. motors, preferably only those of fractional horsepower. For motors of this sort, a manual starter is usually entirely satisfactory and is, in addition, much cheaper.

For somewhat larger motors, one or more accelerating contactors are provided. The line contactor closes the circuit and starts the motor with a resistor in series with the armature. After the motor has accelerated to a definite point, the first accelerating contactor closes and short-circuits a part of the starting resistor. The others follow in turn until the motor is connected directly across the line. The number of accelerating points necessary depends on the horsepower, the type of motor, and the service.

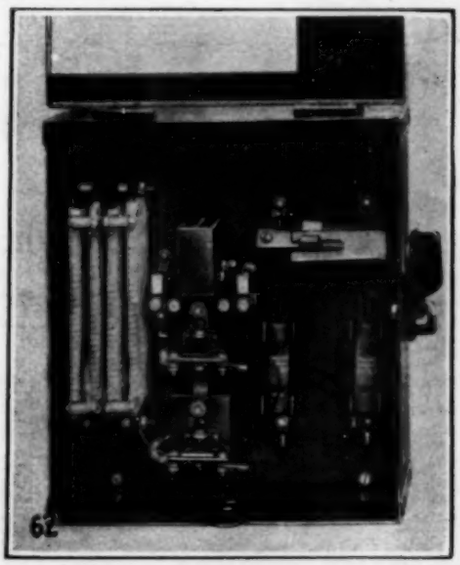
In Fig. 62 is shown a simple automatic controller of this type. It consists of a fused line switch, which may be operated by a handle outside the cabinet; a line contactor; a single accelerating contactor; and a starting resistor, which is shown mounted on front of the panel at the left. The motor is started by pressing the "start" push button, thus closing the circuit to the magnet coil of the upper contactor. This contactor closes, completing the armature circuit of the motor, and starts it with resistance in series. After the motor reaches a predetermined speed, the lower contactor closes and short-circuits the starting resistor. Circuits are provided for holding both contactors closed until the "stop" push button is pressed, or until voltage fails. Controllers of this type are built that do not have the line contactor or push button. A knife switch is closed to start the motor and opened to stop it, with an accelerating contactor to cut out the starting resistor automatically at the proper time.

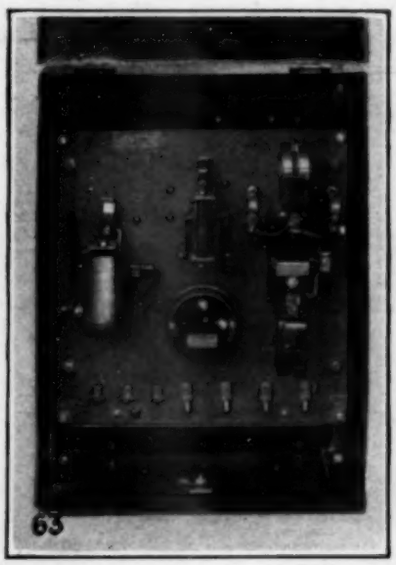
For somewhat larger motors a controller similar to that shown in Fig. 63 is used. This controller is for a 20-hp. constant-speed motor, and is a non-reversing dynamic-braking type with two steps of acceleration and with a thermal overload relay. When used with a two-button, three-wire push button, it provides low-voltage protection. When closed, the large contactor at the right of the panel connects the motor to the line and, when open, closes the dynamic-braking circuit. The thermal overload relay is under the round cover near the center of the panel, while the two other contactors are current-limit accelerators, which close as soon as the line current drops to a predetermined value. The left-hand contactor is the last one to close and remains closed while the motor is running.

In Fig. 64 is shown a 5-hp. reversing controller for a constant-speed motor. It is similar in construction to the one shown in Fig. 63 except for the addition of the reversing contactors. Fig. 65 shows a similar controller for a 20-hp. constant-speed motor. It provides full-magnetic reversing and dynamic braking, a thermal overload relay, and low-voltage protection when used with a three-wire master switch, such as a two-button push button. This controller has two steps of acceleration. Fig. 66 represents a simple reversing panel for a constant-speed motor for traverse service providing one step of acceleration, but without dynamic braking. This controller has no overload relay, but overload protection is obtained by means of fuses.

The number of accelerating points necessary depends on the horsepower, the type of motor, and the service. Adjustable-speed motors, which usually have a low minimum or full-field speed, require relatively few armature accelerating points, provided the controller is arranged to start the motor with the field resistor short-circuited until the armature resistor is completely out of circuit. This method of starting is preferable for adjustable-speed motors, particularly with those having wide speed ranges. The field coils, because of their high inductance, require an appreciable amount of time for the flux to change from that corresponding to the full-field (or low-speed) condition to that corresponding to some higher speed. For nearly all installations and for most motors, this period is all that is required to give satisfactory starting.

The vibrating field relay, which is used by some manufacturers for the purpose of preventing too rapid acceleration, is not necessary when the simpler method of full-field starting, outlined above, is used, unless an unusually long period of acceleration is necessary. At





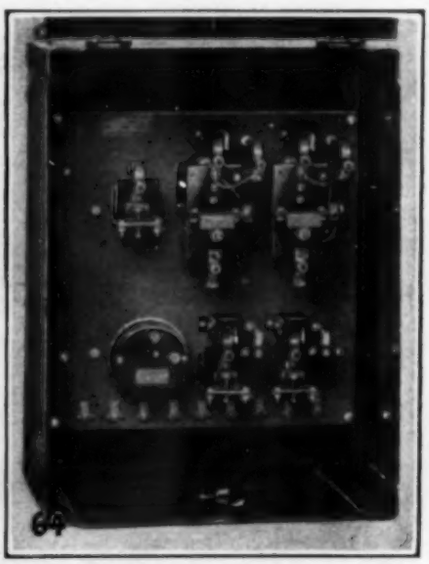
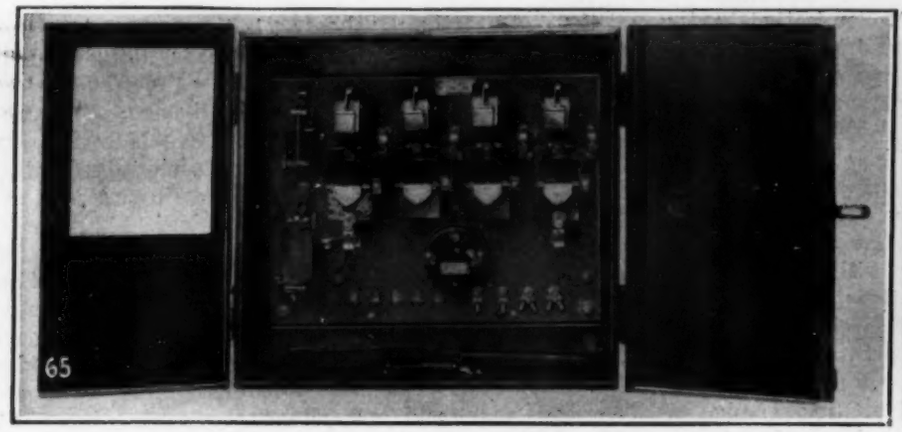


Fig. 62—Simple form of full-automatic controller for a 10-hp. d.c. motor. Fig. 63—Automatic controller for a 20-hp. d.c. motor. Fig. 64—Reversing controller for a 5-hp. constant-speed motor



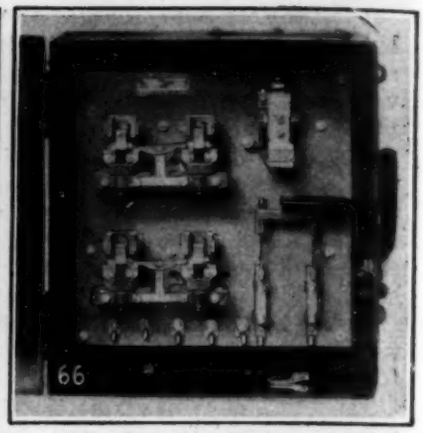
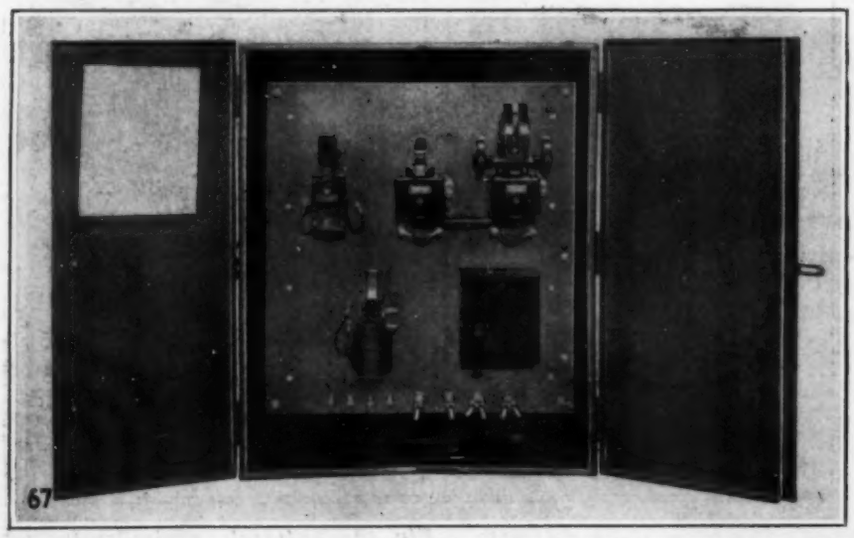


Fig. 65—Reversing and dynamic-braking controller for a 20-hp. d.c. motor. Fig. 66—Simple reversing panel for 20-hp. traverse motor

least one motor manufacturer has designed his motor with this feature in mind. A vibrating field relay at times is a valuable addition to a full-field starting contact, but it cannot replace it entirely. Should a motor be started without a full-field contact and with a full-field relay, the field is weak before the equipment is started. The vibrating field relay will close because of the current inrush at starting, but, as the field takes an appreciable time to strengthen, at least a portion of the acceleration (particularly at the beginning when the motor starts from standstill), is accomplished with a weakened motor field. This means that as the allowable starting current is limited to that which the motor can safely commutate and is consequently fixed for any particular motor, less starting torque is available than when a full-field starting contact is used. When loads having high inertia must be accelerated, the inductance of the field does not give a sufficient time delay to bring the motor to speed properly, and the last part of the acceleration is accomplished with the motor field fully weakened. In such a case, the field relay is desirable in addition to the full-field starting contact.

In Fig. 67 may be seen a non-reversing, dynamic-braking automatic controller, having a thermal overload relay and two accelerating contactors. The contactor at the upper right-hand side of the panel is a single-pole line contactor for starting and stopping the motor. This has two auxiliary contacts, one of which acts as a holding contact for the line contactor, while the other opens the holding circuit for the lower accelerating contactor when the line contactor opens. The middle contactor in the upper row is the dynamic-braking contactor, which closes as soon as the line contactor opens. There is a mechanical interlock between these contactors so that they cannot both be closed at the same time. The thermal overload relay is in the rectangular case at the lower right-hand side of the panel. The lower contactor is the first accelerator, and it closes when the current in the motor drops to a predetermined value. As soon as this contactor is closed, an auxiliary contact closes the circuit to the magnet coil of the contactor in the upper left-hand corner. This contactor, which is normally closed, then opens and inserts the rheostat in the shunt-field circuit. The field strength then falls (slowly because of the inductance of the field windings) to the value for which the rheostat has been set, and the motor is slowly brought up to the required speed.

In Fig. 68, which shows a reversing controller for an adjustable-speed motor, the four contactors at the right of the panel, two on the upper and two on the lower row, reverse the motor and complete the dynamic-braking circuit. The accelerating contactor in the upper left-hand corner short-circuits both the starting resistor and the rheostat in the shunt-field circuit.



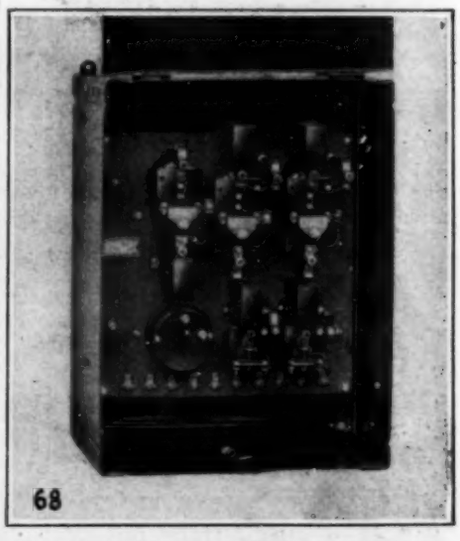


Fig. 67—Non-reversing controller with two accelerating contactors. Fig. 68—Reversing controllers for a 10-hp. adjustable-speed d.c. motor

Did It Pay to Make This Sale?

Two salesmen discuss matters of salesmanship —A case cited in point—Is age or use the more potent factor in obsolescence of equipment

"I HEAR you've got a new sales manager, Jack," said Tom Fuller to his friend Jack Burton. Both were machinery salesmen, and good ones, who met occasionally on the road and tipped each other off as to prospects.

"You've said it, Tom. He's one of these 'slogan' birds, who lies awake nights to invent slogans and catch-phrases. Guess he's just graduated from college or some correspondence school. He thinks all you have to do is to walk into an office, tell 'em how good your machine is, make 'em realize they'd be plumb crazy not to buy it, and walk out with the order. Here's his latest gem: 'Unless a sale shows a profit, the salesman isn't a salesman.'" "Not so bad as a slogan, Jack, but I'll bet he didn't dig it out of his own gray matter. And just the same, it's open to question." "I'm not so sure, Tom, don't you have to make a profit to keep going?" "Generally, yes. Of course, I ought to always. But I know a few cases where it probably paid to spend all the profit in making the sale." "How come, Jack? I'd like the dope to shoot into our slogan guy if it ever comes right." "Here's one case—happened not so long ago. You know Dick Peters? No! Well, he's about the best salesman I know, not even barring myself. Sells Blank drilling machines in this territory.

"Had a tip on a new pump company that had taken over a defunct auto plant, and had a lot of used and out-of-date machines wished on it into the bargain. Dick sold the super on the idea of one of his company's automatics to handle the cylinder job. Convinced him that the machine would handle the work faster than anything else, and the pump company looked like a sure customer.

"Next came a request for Dick to take two old drilling machines of his company's make in trade, and then the trouble began, as it usually does. The machines were in fair shape but they were eight years old and out of date, both as to convenience and production. The fireworks started when Dick's company made an offer of five hundred dollars for both machines, on condition that the pump company scrap one of them instead of shipping it back to the factory."

"That's where the sales manager showed good sense," Jack chimed in. "That new bird of ours would have wired him slogans to use the next time he saw the super. Then he'd have probably gummed the game by going out himself."

"The sales manager took the trouble to explain in great detail why the price offered for the old machines was fair. He told of the decreasing market for the old machines, due to the great improvements in new machines. Pointed out that age alone reduced the value of machines regardless of condition, just as it does with automobiles. It's funny, Jack, that users of machines rarely seem to understand what obsolescence means. They forget that they wouldn't drive a car of ten years ago even if it had never been used and some one gave it to them for nothing." "Don't know as I'd fancy facing a board meeting of 'hard boiled's' who didn't understand the language, Tom." "Well, I don't suppose Dick exactly craved the job either, Jack. But he won 'em over. He told them if they didn't want to invest money in new machines to get the parts made outside by contract and assemble them. Up-to-date shops could make the parts cheaper than they could on their old equipment, and they could install modern machines later. And he knew where they could get the parts made. This line of argument hit their pride and helped him win out."

> Here is a case where the salesman was not only a good engineer but was also diplomatic. He had to sell his machines twice—once to the shop superintendent and again to the man with the check book who knew nothing but price. He also had to show that though an old machine may be in good condition, its value is small when compared to a new machine

"What happened, Tom, and how?"

"The super wrote a long letter to Dick's home office that would take the hide off a dog. Said the price offered 'insulted his intelligence as an engineer,' and a lot of other guff. Letters followed hot and heavy—two- and three-page letters that rehashed the case from soup to nuts. The sales manager took a hand and showed just why the old machines were not worth more to them. Dick wrote letters to both the super and to the home office. Another salesman butted in and the pump company was trying to make up its mind to buy one of his machines. So things stewed around for several weeks with all hands on the ragged edge. That correspondence would be choice reading for any of us. Then the super wired for Dick.

"It came out that the first sassy letter had been written by one of the directors and that the super had signed it because he had to. It was one of those cases

where the bank was running the plant through a board of directors that didn't know a pump from a lawn mower. The super apologized for the letter and skated Dick into a meeting of the directors to tell 'em why they needed the new machine, even if they had to scrap both the old ones.

"All this time Dick was supported by the home office in every move he made. Then came a second directors' meeting and Dick went, at their special request, even though it was in another man's territory. The home office gave him a free hand to play the game as he thought best.

"Well, to make a long story short, Jack—and it was a long story for Dick, running for nine months and including forty pieces of mail and several wires—Dick finally got the order for a full automatic and all the attachments he had recommended. In the meantime, he found a customer for the old machines in places where they couldn't, or wouldn't buy new ones, and so disposed of that sore spot.

"All told, Dick did one of the best selling jobs I know of and the sales manager sent him a splendid letter of appreciation. I tell you, Jack, a lot of sales managers lose out by not backing up a good man on the road and letting him know that they like his work."

"But Tom, what did it cost to sell that machine? Nine months' time—oodles of letters—several long trips—taking time to sell the old machine, etc. Dick's company must have got a walloping old price to stand that expense and still make a profit."

"No Jack, it didn't. It's had to raise prices since then. But I figure it was justified in losing a little money in such a case. It annexed a new customer that is likely to use more machines later. It established a rep for being a live wire on the job. It kept another make of machine from getting a foothold and it got two old machines off the market.

"Some day, Jack, when the millenium arrives, and bootleggers go to peddling buttermilk, customers will have to pay the extra cost of selling machines to them. But at present we've got to judge when it pays to spend most of the profit in making a sale."

"Say, Tom, I'm going to shoot a new slogan to that sales manager of ours: 'The real salesman is the man who retains the confidence of his customers.' Your friend Dick seems to qualify on that."

Is a Smooth Cylinder Wall Desirable?—Discussion

By James McIntosh

I HAVE read the article by John R. Godfrey, under the title given above, published on page 52, Vol. 66, of the *American Machinist*. The answer is, "Yes and no," and both are justified. As a friction-reducing surface a cylinder must be smooth. As a bearing surface, the oil would find a better surface to cling to if it were rough.

A surface may be smooth and yet be porous and as an oil-retaining surface that would be ideal, but as a bore, no one cares to advocate such a condition as a means to resist wear. Surface means material, porosity means absence of surface, and no material where it should be. Certainly no one cares to advocate a bore surface that has the property of a file, so that poor-fitting piston rings will wear until they fit the bore.

A perfect bore must be more than smooth. It should be round, straight, and free from taper. It must be free from any influences that will tend to distort it under any and all conditions. Such a condition is impossible in the present designs of auto cylinders, and the result due to engine operation is in no way similar to conditions deemed satisfactory by the most rigid specification as regards inspection, when at shop temperature. A cylinder that is perfect when cold, is not so when it is in operation. That is the reason why piston rings are used.

The number of special designs of piston rings seem to point out a desire to accommodate all conditions or some special condition. It is suggested that if a perfect bore could be retained and a ringless piston were fitted, and that both could be held at constant and uniform temperature and properly lubricated, piston rings would be a relic of the past, as was the case when hemp and tallow were used to seal a piston operating in a defective cylinder bore. In so far as a bore is free from every influence tending to distort it, so is the problem of sealing a piston simplified.

There are several methods of treating a cylinder casting to relieve casting strains. Seasoning by the aging process is out of the question, and accelerated seasoning due to reheating is of questionable value as a means of producing uniform results. At what point in the process of machining it is done, the process of heating and cooling, time temperature and duration, all must be matters of conjecture. It certainly will not modify the ultimate result of the conditions found in an engine in operation.

Casting strains are a definite and inherent property, but the degree, location and influence are not uniform, due to present high-pressure methods in the foundry. The chemist may control some properties, but he cannot regulate engine design, or do the impossible. The machining operations do not disclose the cause or the effect of a single thing that can be said to be definite to the point where uniformity is guaranteed.

Who is it that pretends to do the impossible?

Surface Hardening of Gear Teeth Here and Abroad

IN ORDER to secure a hard-wearing surface and yet retain the soft core on gear teeth, an English company has developed apparatus and a method of heating each tooth locally with an oxyacetylene torch, and then cooling the tooth with a copious supply of water. A very similar method was developed and used in the Pierce-Arrow plant several years ago for hardening the teeth on starter gears, when the teeth were cut in the flywheel itself. A steel casting was used for the flywheel and the corners of the teeth were hardened in the same way. This process was illustrated on page 116, Vol. 53 of the *American Machinist*. The use of steel ring gears, shrunk on the flywheel, replaced the method in the Pierce-Arrow plant.

Handling Devices of the Southern Pacific

By L. C. MORROW
Managing Editor, American Machinist

By making use of scrap and other parts that are to be found in any back shop the Southern Pacific has constructed some devices that have greatly reduced the time required for handling flues, superheater units and other parts

MANY of the parts stripped from a locomotive after it arrives at the shop for repairs must be soaked in lye or other cleaning medium, for the removal of grease and dirt. The so-called stripping wagon, illustrated in Fig. 1, is in use at the Los Angeles, Calif., shops of the Southern Pacific. Parts are placed in the wagon as they are removed from the engine and, when full, wagon and parts are run on rails to the outdoor vats, and immersed. When the parts are clean, they are transported in the wagon back to the shop to be distributed to the machines, assembly floor, or locomotive. The wagon is made of old boiler sheets, old rails, and discarded truck wheels. The perforations in the sheets form the necessary outlets for the cleaner as the wagon is lifted from the vat. For revolving the drivers when setting valves, the apparatus shown in Fig. 2 is used. Compressed air, instead of man, supplies the power. There is no good reason why the handling of flues in stripping and assembling should be accompanied by a lot of back-breaking manual labor. The truck, Fig. 3, functions as an aid in handling as well as a transporting device. It is fitted with a platform, adjustable vertically, to receive the flues and a ladder to give access to the platform. Not very much new material was used in its construction, which means that there are enough wheels, beams, and pieces of iron lying around any shop from which a similar truck could be constructed. Even if made of all new material the truck would pay for itself within a short time. A somewhat similar device is shown in Fig. 4. It is used in handling superheater units. The chief distinction between this truck and the flue truck is that the superheater units are transported around the shop on an auxiliary truck, which must be lifted to the top of the main truck by crane. This arrangement is, of course, of greater convenience on the superheater job. There is probably no way of reckoning exactly the savings that result from the use of the devices described. There are, however, several obvious advantages that cannot help be accompanied by reduced costs. They are the reduced man-hours; the freedom of cranes; and the less extravagant use of physical effort. There is another consideration that may offset all three of those named, and that is reduced shopping time for the locomotive itself.

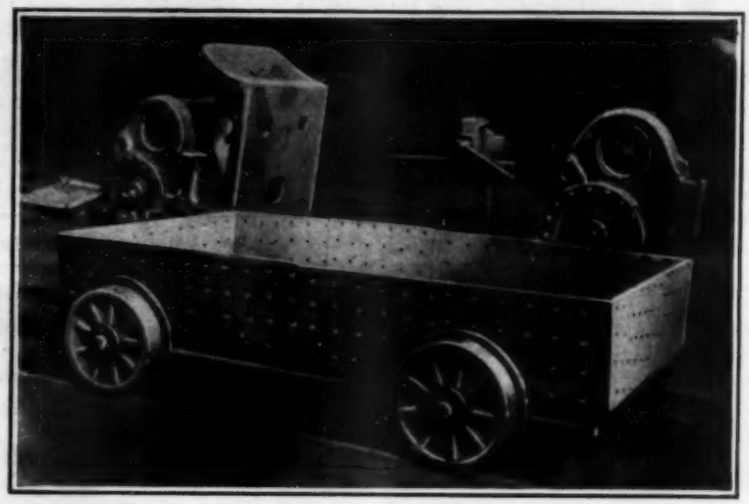


Fig. 1—Stripping wagon made of scrap parts

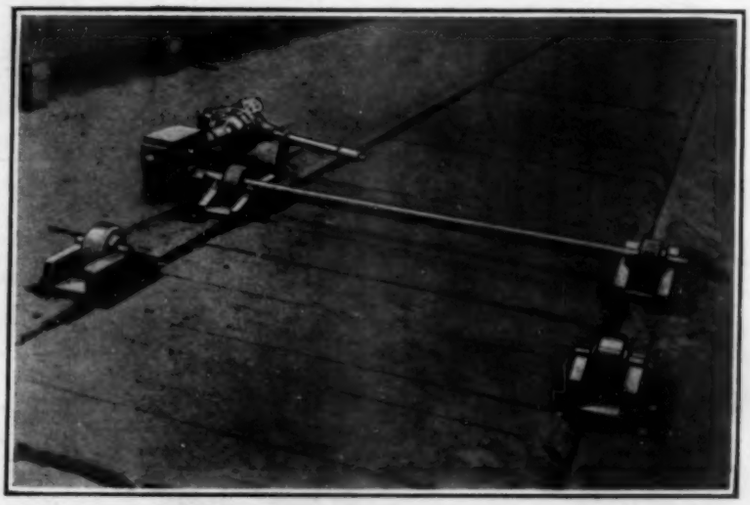


Fig. 2—Pneumatic device for revolving drivers

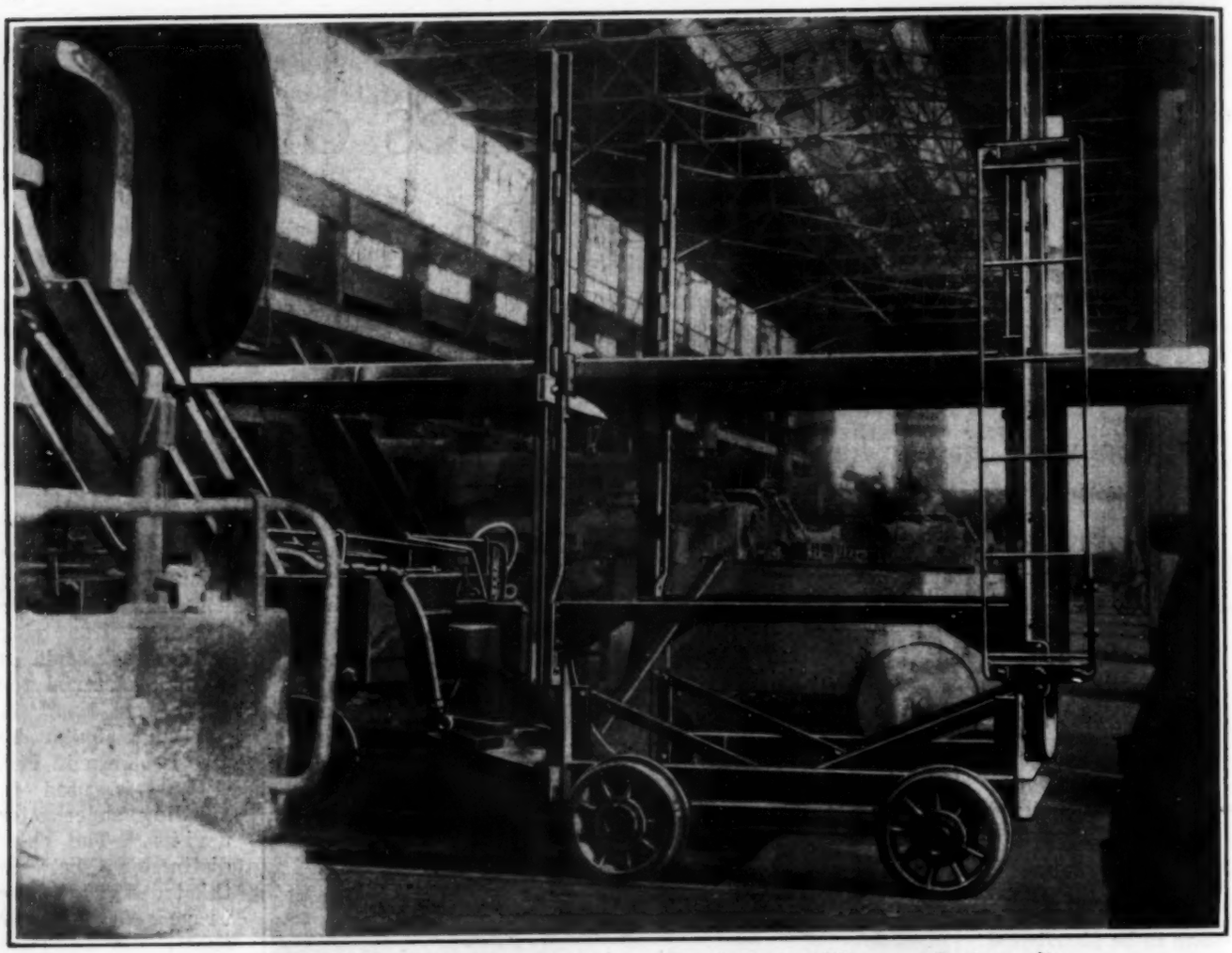
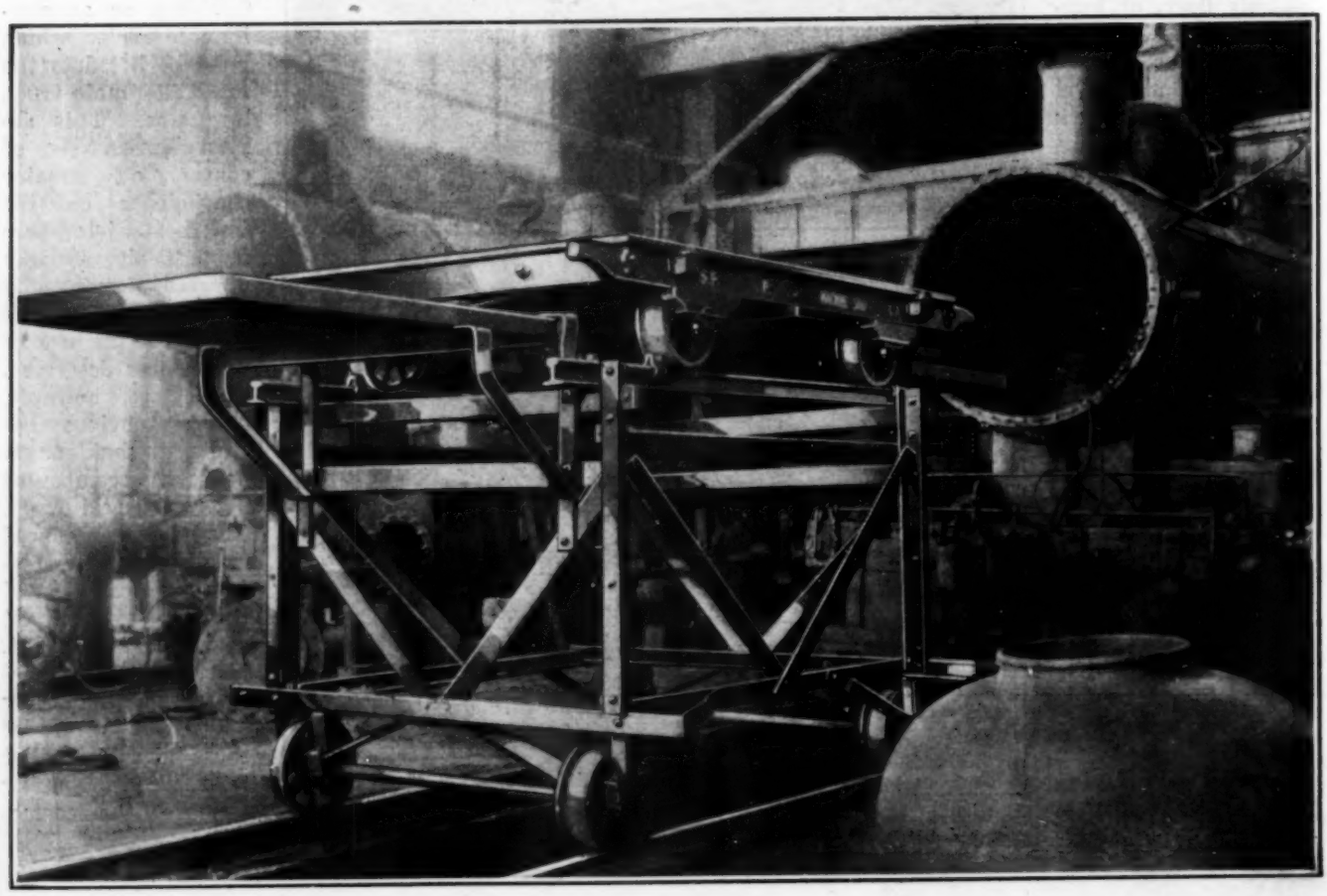


Fig. 3 (above)—Flue truck. Fig. 4 (below)—Truck for handling superheater units



Orderly Maintenance in a Diversified Manufacturing Plant

By Frank I. Wheeler, Jr.
Plant Engineer

Machine inspection initiated by the tickler file—Identification of machines—Repair history cards—Belt inspection, maintenance, and records—Upkeep of other transmission equipment

MACHINE inspections are also regulated by the tickler as explained before. The inspection periods were first assigned according to best judgment. They have since been adjusted to fit operating requirements for each machine as shown by its repair history. The inspection dates have been so arranged that the machines to be inspected on the same day are closely grouped in location in the plant. As many as three or four machines of a day's inspection are placed on one tickler ticket. By this means the tickler file is made more compact, while at the same time the back of the tickler card has not been crowded for reports. When a major repair is made on a machine, it is inspected at short intervals. By means of special tickler cards, new machines are similarly watched until proper operation is assured.

The inspector reports the condition of the machine on the back of the tickler ticket that initiates this work. In addition, he notes on the same slip recommendations for spare parts to be kept on hand, alterations in inspection periods, safety guards that are desirable, changes in speeds, improvements in loading, tooling, and in operation. He is required to devote at least a quarter hour to the inspection of a machine, and must not accumulate inspections for several days before making a trip through the plant. In this particular plant, the foreman of the machine shop makes all the machine inspections, but it might be more desirable in general practice to have different inspectors examine the machines on alternate dates.

Some of the tickler cards have noted upon them special features that are to be watched on that particular machine. When of consequence, a list of tools that go with a machine is also placed on the ticket for check at the time of inspection. Machine tools fall in this classification. For identification, all movable parts of a machine or a tool have the machine number stamped upon them. Inspectors are also required to obtain from the operator or foreman in charge of the machine comments on its performance. These are also noted on the back of the inspection ticket.

The plant engineer reinforces inspection and shows an interest in the condition of equipment by questioning the foreman and operators from time to time. Many

The second article. The third and concluding article will appear in an early issue.

EQUIPMENT RECORD

Description Shaper- Heavy duty size 16" MACHINE NO. 4551

Make Gould & Eberhardt Makers No.

Bought of Maker Order No. 7645 Date Feb 1920 Cost $882 KA 163

R.P.M. H.P. Volts Amps K.W

MACHINE TO BE INSPECTED EVERY 6 months

INSPECTED	REMARKS	REPAIRED	TIME HOURS	INSPECT AGAIN
March 1920	Installed	B	B- 11 1/2 C-11	
10-30-20	OK.		D- 2 1/2	
3-5-21	needs thumb screw in graduation collar on Cross slide	5/31-21	B-2	7-6-21
7-6-21	OK			11-2-21
11-2-21	OK			3-3-22
3-3-22	OK			7-9-22
3-15-22	Make 2 new screws for kick in vertical feed.	3-15-22	C-2	"

Fig. 3—Machine record card

BELT RECORD

BELT NO. 16 L.S. 3-2

Location	Counter-shaft to Main Shaft	Length Over Pulley	20'-0"	Max. Velocity	
Purpose		Width	3"	Min. Velocity	
Kind	Leather	Thickness	Single	Max. Tension	
Maker's Name	E. R. Ladew	Cross Section in Sq. In.		Min. Tension	
Date Put in Use	8-29-24	How Fastened	Clipper Joints	Cost of Belt	
Date Taken Off		Belt Grease to be used		Cost of Maintenance	
Life of Belt		Belt Dressing to be Used		Total Cost	

Date Re-Tightened	TENSION IN LBS. Before	After	Amount Taken Out	Date Tension Should be Taken Again	Date Cleaned and Greased	Date to be Cleaned and Greased Again	Date Dressing Put on During Service	GENERAL REMARKS About Work Done on Belt, and Condition of Belt, Etc.
8-29-24			New	9/5-24				
9-5-24			0	9-19-24				
9-19-24			3/4	10-19-24				
10-19-24			0	12-19-24				
11-22-24			3/4	12-19-24				
12-19-24			0	4-15-25	6 month inspection periods Last.			
12-9-25			3/4	4-15-25				

Fig. 4—Belt record card

improvements have resulted from this practice. An occasional check inspection is made by the plant engineer or his assistant to insure that inspections are kept up to standard. In order to maintain a high morale, care is taken that the inspectors and others that make recommendations receive direct evidence that the recommendations have been noted and approved, or, if not approved, a reason is given. If an inspector recommends a repair, a maintenance order is issued upon receipt of the inspection report. Important machines are examined just before their busy season so that if repairs are found necessary they can be completed in time for operation on full schedule.

Machines are identified by a mnemonic system. First comes the number of the room in which the machine is located, then the symbol for that type of machine, and finally the individual number of the machine. For example, machine 8R1 is rolling mill No. 1 in room No. 8. In this way machines can readily be located when maintenance orders are used. In a book of blueprints made from the room layout tracings, each machine outline has its number marked on it in red. The same number is placed upon the machine itself in white characters $\frac{3}{4}$ in. in height in a position where it can be easily read.

If a machine is moved to another room, it is given a new number and a record is started on a new card, cross-indexed so as to refer back to the old card. Thus a complete history of the machine is always available. The old card is filed in an inactive file that has three sections under the following heads: Sold or Detroyed, Relocated, and Reserve. When a regular card has been removed from the active file, it could be replaced by a distinctive marking card that would show the location of the new card and yet preserve the number record intact in the regular file. This procedure would eliminate confusion in the card records if the number of equipment changes were large. If a machine is moved or discarded, its individual number is never used again in that room. The next machine of similar style is given the next consecutive number over the highest individual number in use for that style of machine in the room.

The machine cards are 8x5 in. in size and tan in color. Fig. 3 shows such a card with typical notations marked thereon. On the top is placed the name of the machine, its size and number, the name of the manufacturer, the date of purchase, the price paid, and special information, such as the speed of the spindle of a grinding machine. The first entry made in the space provided for the history of the machine records the installation and gives the hours of labor. The workmen are indicated by code letters. Later entries on the cards describe repairs that have been made, together with the amount of labor involved, inspection reports, and warnings on weak features of the machine. The date of each repair and inspection are noted in every case. As a later development, material costs have been entered as a part of the description of the repairs or improvements in the history space. It would be of advantage to concentrate this data in an extra column under the caption "Material Costs."

All machine cards are filed in a single drawer and are divided into five classes with the aid of colored clips. Machines that are undergoing repair are indicated by blue clips on the cards. Red clips indicate that the machines are chronic troublemakers or have some objectionable features that must be remedied. A green clip indicates that an improvement has been recommended and approved for installation when a design can be developed. A yellow clip indicates that the machine is idle but has not been definitely discarded. The absence of any clip indicates that the machine is in good working order. When a blue clip is removed from the card upon completion of repairs of a machine a white clip is placed thereon. These white clips accumulate for a year so that the relative machine repairs can be compared and summarized. In the past year the number of red clips has been reduced from fourteen to two and the number of yellow clips from fourteen to one. Some of the latter machines were definitely discarded, but quite a few of them were adapted to new uses. The

various colored tabs are counted weekly and noted on a record card. Machine cards are filed first according to room number, so that all the machines in the same room are together, then alphabetically from the machine symbols, and finally by individual machine number. Each machine with a countershaft drive has a plain white card filed directly back of the machine card that gives the history of the countershaft.

A card listing all spare parts is kept in front of the machine card file and is checked over annually. Each spare part has a tag fastened upon it and when used the tag is turned in to the maintenance department. A maintenance order is then issued for its replacement or for the purchase of a new spare part.

In some cases schedules are fastened to the machine cards that give the best procedure to follow in making repairs. In the case of the 2½-ton roll of a large rolling mill, for instance, the necessary auxiliaries for replacing a broken roll are listed and kept in storage so that minimum time is lost when the work is undertaken. Some of the items regularly inspected on machines are: the tightness of bolts holding arms in place, especially when the machine is subject to vibration; the adjustment of brakes and clutches; the adjustment of gibs to proper fit and of springs to proper tension; the condition of threads on bolts or fittings, or blades on shears; the condition of gear teeth and the amount of backlash; the play in bearings; the line up of pulleys; the fit of tools and fixtures; the smoothness and accuracy of sliding working surfaces; loose setscrews, collars, and nuts; lost motion in feed screws; cracks in frames; and the need for safety guards.

The duties of the tickler in regard to maintenance of machinery are many. For instance, the highest-pressure indicator on the hydraulic press is reset monthly. In certain rooms, the hydraulic presses are idle a portion of the year, and they are then run weekly in order to keep the pump and press packing in good condition. The various bolts on drop hammers are examined and tightened every three months. Housing bolts on rolls are examined and tightened every month. Steam-hammer cylinders are opened each year and the cylinder and piston rings examined. The lining and hearths of large annealing furnaces are examined twice a year. Water is pumped from under the fuel oil storage tank every six months. These items and many others are taken care of regularly by means of orders initiated through the tickler in the manner explained above.

Complete records are kept on the various belts used throughout the plant. The machine belts are numbered by using the machine number, then the individual number of the belt separated from the former by a dash. Belts are numbered consecutively as they progress from the machine to the main shaft. For example, belt No. 1 would drive from the countershaft to the machine, while belt No. 2 would drive from the countershaft to the main driving shaft. Belts on jackshafts, from which several machines are driven, are given numbers that include the symbol *JS* preceded by the room number and followed by the jackshaft number. Belts that connect the jackshaft to the main shaft are given the jackshaft number and the individual belt number as for machines. Motor belts are located by using the motor number in the same way as the machine number.

Belt records are kept on cards as indicated in Fig. 4. The card measures 8x5 in. and is white in color. The cards are filed in groups according to room number. Such information about the belts as size, length, maker, identification number, location, and engineering information is contained on this card. Space is also provided for a complete history of the service of the belt, such as the date of installation, subsequent tightening with the amount of slack taken out, date of repairs, and notes as to condition when inspected, such as oiliness. Contrary to the practice with machine cards, the inspector's O.K. is not entered upon the belt cards. It was thought that the inspector's O.K. on the inspection tickler card serves as a sufficient record in the case of belt inspections where no defects were noted. In this way, clerical work is reduced.

When a belt is discarded and a new belt installed, the latter receives the same number as the former, but its record is started on a new card. The old card is filed in a special section provided for that purpose. These old records have proved to be of much value in determining the best belt for a drive.

Belting inspection is controlled by the tickler system. Each belt has its own individual tickler card. Belts to be inspected on the same day are closely grouped in order to reduce traveling time in the plant. New belts are inspected at the following intervals as recommended by Taylor: one day, one week, two weeks, one month, two months, four months, and every six months thereafter. Six months is the regular inspection period for nearly all the old installed belts. If a new belt replaces an old one, arrangements are made to have

Main Shaft Room 4 Size 2 7/16" R.P.M. 145

	Inspect for line & level every 2 years Begin Feb 1924	Repaired	Time Lapse	Inspect again
8-20-23	Tighten all couplings	9-4-23	B-2 D-2	2-2-24
2-2-24	Lined and Leveled	2-11-24	B-5½ D-5½	2-2-26
8-2-24	Tighten hanger nuts	8-3-24	B-3½	
2-2-25	Tighten stringers and all hanger nuts	2-2-25	B-1½ D-1½	2-2-26
8-2-25	Tighten hanger nuts	8-9-25	C-1½ D-1½	
10-14-25	all roller bearings inspected for wear. condition very good.	10-14-25	C-8	
2-2-26	Inspect for line & level & tighten hanger nuts Cut 3/16" some places	2-2-26	B-3 C-3	2-2-28
5-26-26	Tighten loose bolt in coupling.	5-26-26	A-½	

Fig. 5—Transmission equipment record card

its 6-month period inspection fall on the same dates that were used for the discarded belt. In this way the old tickler card and its routine is preserved intact. The old card is removed from the tickler file and placed in a special file indexed by rooms, where it remains until the new belt is ready for 6-month inspection periods, when the tickler card is again put in service. In the meantime, a special tickler card (white) having dates corresponding to the short inspection periods marked thereon is used for these inspections. The tickler cards for belts are marked in the same manner as for machines. That is, the active date is written at the top and under that the symbol of the belt to be examined. Inspection reports are written on the back of the card as before. This regular inspection of belts forestalls the shutting down of machines at busy moments in order to tighten them. It also keeps them properly dressed and in general good repair. Each belt receives a dressing treatment depending upon the judgment of the belt man, although a standard belt dressing has been approved and is supplied. His inspection O.K. certifies that the belt is properly dressed.

Maintenance orders are issued for extensive belt repairs, but ordinary belt tightening is done without an order being issued. Note is made upon the daily time slip of such tightening, however, with the amount of slack removed. These notes are later transcribed to the belt card.

Regulations have been made specifying the type of belt joint to be used. The repairing of belting by insertion of short new sections 18 in. long and under has been discontinued to prevent the presence of two joints on the pulley at the same time. A belt is always examined carefully if an excessive amount has been taken out for tightening it. In order to facilitate the handling of overhead belting and other transmission equipment, the ceiling lights have shades so designed that part of the light goes through the top of the shade and thus illuminates the belting.

Cards for Shafts

As stated before, mainshafts and jackshafts are numbered and have card records similar to machines. The cards are white and of the same size as the machine cards. They are filed in the machine card case just in front of the machine cards of the same room. On the shafting card is noted, as seen in Fig. 5, its title, room number, size, and speed in r.p.m. on the top of the card. In the body of the card a complete history of all work done upon the shaft and notes as to its condition are given. By means of the tickler each shaft is examined for alignment once every two years. Nuts on the hangers and coupling bolts are tested for looseness in most cases every six months.

In making transmission alterations, quite a few pulleys accumulate and a reasonable number of them are kept as reserves. A tag with perforated lower section has the size and kind of pulley written upon it and is fastened to the pulley. The perforated bottom of the tag containing the same information as the top half is turned in to the maintenance department. When a pulley is required these stubs are examined to see if a particular size and kind of pulley is available. When the reserve pulley is installed, the two parts of the tag are destroyed.

Transmission equipment is oiled regularly according to a specified schedule. Special oiling requirements, however, are controlled by the tickler. The same man that is responsible for the oiling of the transmission equipment also takes care of the lubrication of all machinery in the different rooms, except in those instances where the operator running the machine steadily is responsible. The oiler also serves as an additional inspector on mechanical equipment and is expected to turn in recommendations when repairs are required. The machine shop is required to call to the attention of the oiler any new piece of equipment or repaired equipment that needs special attention. Through the use of the right type of lubricant and the proper treatment of belts, the work of maintenance has been reduced so that this work can be taken care of by a single man.

Ladders are considered a part of the millwrighting equipment. They are painted a uniform dark green and are numbered according to the room in order to keep the ladders where they belong. They are inspected every three months to see if they are in safe condition. A card is kept in the maintenance office that lists all ladders according to rooms. Hoists and chains are also examined every three months for their safe condition, while trucks and skids are inspected twice a year.

Air-Hardening Steel

By L. L. Thwing

PLUMIER, in 1701, gives the following information regarding Damascus steel. After discussing the various kinds of steel available in France at that time he says, "I say little about Damascus steel as little of it comes to us here in France, nor do our workmen know how to harden it. Here is what I learn from merchants who have traded many years in and about that country. They say that in many parts of the Levant they use no steel for swords except that which has been used for horseshoes, saying that the hoofs of these animals have the virtue of refining iron.

"These merchants assure me that the Turks do not harden their swords in any liquor whatsoever but only in the air and this is the manner of it. Adjoining their forges they build a large wooden funnel with the large end facing north and the small end, which is just large enough to receive a sword blade, close to the fire. When they wish to harden a sword, particularly in winter, they wait for the north wind. When this wind blows through these funnels it is so cold in the narrow opening that it is impossible to hold the hand there. The workman having heated a sword to a certain redness, quickly thrusts it into the slit in the funnel and holds it there until it is cold."

This method, in fact, should be better than hardening in any liquid since the hardness of tempered steel is due entirely to the fact that the particles expanded by the heat are suddenly contracted together and united by the cold of the liquid. The liquid is warmed by the hot steel and thus becomes less effective. This, I believe, is the reason why tools are often hard enough at first but after a little grinding become so soft that they must be hardened again. When the water is cold enough, the particles of steel on the surface are hardened by its force but this effect is lost as the water is warmed by the steel.

In hardening in the air this is not the case, for although the steel is hot, the air is not warmed.

Book Reviews

Textile Bleaching, Dyeing, Printing, and Finishing Machinery.—By A. J. Hall, Chief Chemist, Silver Spring Bleaching and Dyeing Co., Ltd. Three hundred twenty pages, 10x7½ in. Cloth boards. Indexed. Three hundred sixty-five illustrations. Published by D. Van Nostrand Co., 8 Warren St., New York. Price $14.

This book is a general text on the machinery used in the finishing of fabrics after weaving or knitting. It treats of the subject from the standpoint of the user of the machinery, rather than from that of the designer or maker. The machines described are all of British manufacture.

The volume is divided into three parts and nine chapters. The first chapter deals with machinery for preparing fabrics, and is illustrated with 79 pictures and line drawings of machines. Machinery for dyeing, mercerizing, printing, and finishing are covered in the next three chapters. The second part describes machines for the treatment of yarns, while part three covers machinery for loose fabrics and knitted materials. The scouring, dyeing, and finishing of knitted goods is dealt with in detail, and machines for the various operations are shown. The final chapter describes miscellaneous machinery used in the various textile mills.

The book gives in detail the purpose and operation of all machines, and makes comparisons of the results obtained with the various types. It should be a valuable text for anyone interested in the equipment of a modern textile plant.

The Marketing Problem—How It Is Being Tackled in U.S.A. By E. T. Elbourne, director of marketing investigation, Shaw, Wardlaw and Co., Ltd., England. Two hundred and sixteen 6x9-in. pages, cloth boards. Published by Longmans, Green & Co., 55 Fifth Ave., New York City. Price $4.

Written particularly for British manufacturers and merchants, this book nevertheless is an excellent marketing guide for American business. It tells what is really being done in the United States to solve marketing and distribution problems, especially in regard to manufactured products. There is no attempt to tell the reader how to do his marketing—rather is the effort to show what is available in the way of analysis, service, and literature that the individual or company may apply to specific problems.

Beginning with a chapter by L. P. Alford, to outline the present economic tendencies and aspirations underlying them, the book deals with commercial research, official information service (by the Bureau of the Census, Bureau of Foreign and Domestic Commerce, Bureau of Standards), elimination of waste, trade association activities, auxiliary marketing services, budgetary control, the marketing counsel, publication surveys, advertising, institutional publicity, printed salesmanship, distribution, and marketing literature.

As individuals, and as producing units, we need to know more than we do about what our country as a whole has done toward the solution of marketing and distributing problems. The author evidently felt the same way about the business men of his own country. The inspiration back of his work is expressed admirably in the foreword, written by Sir Josiah Stamp: "Until recent decades, we focused attention on making things, and when they were made, economists and industrialists almost lost interest in them. Now we realize more fully that a thing is economically valueless until it gets to the place where it can be properly used and into the hands of a final user, and that these stages are just as important for the study of total 'costs of production' and for the enrichment of the world, as the factory stages." This book will do much to point the way toward getting the products of our factories into the hands of the final users.

Migration and Business Cycles. By Dr. Harry Jerome. Two hundred and fifty-six pages, 6x9 in. Cloth covers. Illustrated with graphs and diagrams. Published by the National Bureau of Economic Research. Price $3.50.

In "Migration and Business Cycles," Dr. Jerome analyzes the economic causes and effects of migration, with particular regard to the supply of labor in the United States. The basis of this study of the relationship between industrial cycles and American immigration and emigration can be found in two questions. To what extent are fluctuations in migration attributable to fluctuations in employment, and to what extent, in turn, are fluctuations in migration an ameliorating influence or an aggravating factor in employment and unemployment fluctuations?

The study indicates that there are both strong cyclical and seasonal movements in immigration and emigration, and there is abundant evidence that when immigration is not restricted the character of the cyclical variation is closely parallel to the cyclical variation in employment opportunity in the United States. A fairly close similarity is also found in the seasonal movements. The seasonal increase is in the Spring, well-timed for the summer increase in those outdoor activities in which many new immigrants ordinarily find employment. The maximum emigration is reached in the late fall and early winter when jobs are becoming relatively scarce. Similarly, a period of depression in the United States is ordinarily accompanied or closely followed by a decline in immigration and an increase in emigration; and a period of prosperity is followed by an increase in immigration and a corresponding decrease in emigration. The book is well worth reading by those interested in the subject of immigration in its relation to industrial operations.

An Investigation of Twist Drills. By Bruce W. Benedict and W. Penn Lukens. One hundred forty-four pages, 6x9 in., paper covers. This booklet is published as Bulletin No. 103 of the Engineering Experiment Station, University of Illinois, Urbana, Ill. It contains the results of experiments conducted in the University laboratories and in manufacturing shops. These experiments were conducted and recorded with the object of solving a number of problems relating to drilling. The absorption of power by the drill press, and the endurance of the drill for different angles of grinding, were among the points investigated. There are 59 illustrations showing the test apparatus, drills and points, chips, and diagrams of the results of the tests. The price of the book is 60 cents.

THE · FOREMAN'S · ROUND · TABLE

Is the Repetitive Operation to Be Avoided?

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"ED, the more I see of Frank Carrigan the better I like him, and the more I think he knows. If it won't bore you, I'll tell you about one of his experiments."

"I'll let you know if I get sleepy, Al. Shoot."

"Frank told me that when he left for that year of travel he thought his dad was all wrong about keeping a man on the same old job all the time; had read much about the evils of repetitive monotony, and was agreeing about 100 per cent with the theorists. While he was going around he talked to personnel managers about it and to men on the job. Now he has different ideas.

"He talked to press operators, assemblers, filers, polishers, and so on. Apparently they had never had thoughts of monotony. He told me the details of many of his interviews, but I'll not attempt to repeat them. I'll get down to his conclusions.

"They were much like this: That repetitive monotony does exist, and that it's about the same as a life sentence to some people if forced to do a repetitive job, but that the number of people forced to do that kind of work against their wills is very small.

"That to other people simple, repetitive operations are a Godsend. They don't want responsibility in their work, they don't want to think about it, or can't, and they do want to dream—either about what they know they never will do, or about things that they have done.

"That people by the law of natural selection will gravitate to the type of work for which they are fitted, and that the repetitive job is the proper place for many of them.

"So he experimented in his own shop on the press department. Took men out to relieve them of their monotony—and most of them asked to be put back. Put the bolting-up men, one at a time, on work that required thought, skill, and attention, with the result that he got spoiled work and unhappy men. So now he limits his experimenting to having the personnel department make observations of the repetitive workers, in the shop and out, too, so far as it can without prying. As the data grew, his changed opinions were confirmed. What do you think of the little story, Ed?"

"Well, I'm not asleep, anyway, Al. I'm not much up on repetitive monotony, and I don't see exactly where the foreman comes in on it. But it surely is interesting stuff, and gives me something to think about."

Why should the foreman interest himself in the theories and actualities of repetitive monotony?

What has been your experience in shifting men from job to job to keep them from getting into what seems to you to be a rut?

Is the repetitive worker more often injured at his work? If so, do you attribute that result to dreaming?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Getting Men to Observe Safety Rules

IN THE MATTER of safety in the shops as with many other things in engineering, we have to decide whether we want to merely make a big show or whether we want to really accomplish something. The walls of the shops can be adorned with "By Orders" calculated to put terror into the heart of the user of the cone pulleys and to impress visitors with the humanity of the company but if one wants to stop accidents he must look to the foreman. In spite of rules to that effect how many of us would ordinarily take the trouble to stop a machine and change the belt on cone pulleys by hand. We all agree that it is wrong and yet we go right ahead and do it. There may be as many rules as you like but unless the foreman takes a hand it will need more than ordinary talking to see that they are carried out. The trouble is that most safety devices are a nuisance and some, such as milling cutter guards, are more dangerous than none at all. If all the safety rules possible were adopted the operator would scarcely dare touch a machine.

The best way is to let the men know that there will be trouble if they are found handling a machine in a dangerous way and then let the foreman know that the safety of the men will be on his shoulders. If the foreman says, "Now look here, Joe, you've got to shut down before you change that belt over. Maybe I should do the same as you are now but if I catch you at it again there'll be trouble. Get me?"—a lot of dangers will be reduced.

A. L. WALKER, *England.*

Making Good Workmen Out of Poor Prospects

WHEN the labor supply is plentiful we are apt to pick only those who have the best recommendations and a good personal appearance but as men for the job become scarce, we begin to take chances on those who do not appear so promising. I have seen some of these sorry looking individuals with no personality develop into surprisingly good material as workmen. They have been faithful and loyal to the concern that hires them and more appreciative of efforts made to use them right than some of the more socially gifted employees who have not had to make themselves known through unusual accomplishments.

I feel that much good can be accomplished in the direction of increasing a man's pay automatically and voluntarily to a general maximum wage in keeping with that paid in a certain locality for that kind of work. It is being done in other lines, why not in the industrial field? A voluntary pay increase should cut down labor turn-over. Men will quit when another job at more money is offered them before they even inquire from the foreman whether they are due for a raise or not. They would hesitate about changing jobs if they knew the company was carefully rewarding the men who were improving in their work.

—WALTER E. SCHOBER, *Drafting Instructor.*

Making Good Workmen Out of Poor Prospects

GOOD personal appearance and a congenial manner are both assets to the man possessing them and usually give a man preference over those not having these qualities. The man of opposite characteristics may after a time get the attention that he rightfully deserves but he is almost sure to be a second choice because his good points are so deeply buried. Al is to be commended for raising Schimmel's pay voluntarily. Such a policy on the part of an organization establishes a feeling that the service rendered by the employees is carefully watched, appreciated and recognized in a material way. It likewise makes those who are not doing their part aware of the penalty that they face. It will make the latter class realize their standing and perhaps lead them to improve their work and behavior. A foreman's value is based to a marked degree on his ability to recognize and to stimulate latent and dormant talent, therefore he should be ever watchful of the unpromising men and boys. It is an important part of his job to give them every encouragement and to see to it that they improve, otherwise his department will be losing ground. While he cannot be entirely successful in all cases, I believe that as a general rule the time and effort used in this way are well spent.

—JOHN MARK MAY.

THE · NEXT · TOPIC

Do We Buy Labor or Production?

QUESTIONS

Al's voluntary raise of Schimmel's pay has caused comment. Some say he had no right to do it. Is labor a commodity to be bought at the lowest price or do we buy production capacity?

Cutting Down Spoiled Work

STAGING a spoiled work exhibition should have a good effect on the men but it must be borne in mind that even the exhibition may in time lose its effect and be considered as a gag on the part of the estimating department unless Ed happens to be the kind of foreman greatly liked and respected by his men who may realize then that he is getting into serious trouble because of their spoiled work.

It is a good idea to take the person responsible for scrapped work direct to the estimating department where the actual cost of losses due to his carelessness may have the desired effect and thus prevent a repetition of the offense. If it does not improve his accuracy it may be necessary to fire him since carelessness is a disease that is contagious.

The foreman must remember, however, that rejected

work frequently is the result of speeding a man too much. Another frequent cause of inaccuracy are the gages. Those gages that are subjected to constant use should be frequently compared with master gages before they are handed out for use.

—NORMAN UCKEY, *England.*

Getting to the Big Boss

DURING about forty years' experience in drafting rooms, engineering departments, and in the shops of large corporations on various lines of work, I have noticed that a real big superintendent knows personally the capabilities of the men in the plant, and I have seen them time and again stop and converse with the men relative to the work they were doing and on other matters. Now, if all plants had such superintendents, it would be an easy matter for any shopman to take up a grievance that he might have with his foreman. Such superintendents would give the men a square deal, and would not be swayed by anything but the truth in the case. The men, however, would not be uneasy as to what the foreman would do to them if they went over his head. Such a type of superintendent, too, would not care a rap if any foreman went over his head to consult the general manager.

I know of a case where the very first suggestion that came from a workman after the institution of a "suggestion box" was "Fire the Foreman." The workman making the suggestion signed his name, of course, but did not lose out. On the contrary, he was congratulated, and in time the foreman was ousted for incompetency.

—GEO. W. CHILDS.

Cutting Down Spoiled Work

THE inspector must assume the responsibility of proving his judgment, therefore, it is unlikely that he will often run the risk of being unfair in gaging the quality of a product. On the other hand, if the gages used by the production department are defective, the fault should fall on the shoulders of the inspection department which should be responsible for the accuracy of all the gages in use.

If a workman spoils a piece, the methods rather than the men are often to be blamed. The only way to avoid a big junk pile is to think out successful methods that do not allow a worker to spoil pieces. It may be well to show the workmen the losses in dollars and cents but it would be more logical to find the causes and to remedy the troubles.

—R. SENAY.

Making Good Workmen Out of Poor Prospects

"BY THEIR works ye shall know them." That is how Schimmel and Al knew each other. If Al hadn't given more pay when Schimmel gave him more work he would have been dishonest. That is a form of dishonesty as common as bootlegging. For the foreman honesty is a very wise policy.

Personal appearance and disposition in many cases are much more evident than actual ability. This is a condition and not a theory, and it is a very natural result of the fact that these two factors force themselves to the foreman's attention every time he sees the man. Ability to do more or better work often has to be very pronounced before the foreman is aware of it.

A little consideration and attention will often develop the man or boy with a poor personality into a workman who is much more loyal and dependable than the one who never has had hard knocks. A great deal depends on the foreman's own experience. If he has been helped he can help others. A man with a poor personality will do better as he stays longer in a place. More and more his personality will be forgotten and his work appreciated.

—JOHN C. TONKIN, *Instructor.*

Making Good Workmen Out of Poor Prospects

IT CERTAINLY pays to spend time developing unpromising men and boys when they have once been engaged, at least up to the point where it can be definitely said that they are not capable of handling better work. Even in the latter case it may be the method of training which is at fault. There are, of course, cases where there is no desire for further advancement since they do not want to be worried with changes of occupation and are quite content to put their whole mind into work with which they are familiar.

Al did right in raising Schimmel's pay without waiting to be asked. The two dollars he gave would result in more satisfaction to him and to the company than more money begged for. There are men who will not risk the refusal of an increase and will prefer, therefore, to apply for another job with a different employer. Men's expenses grow as they advance toward middle age and it is quite natural that they should expect their earnings to increase, since they are acquiring more skill and experience. If their earnings do not increase they are likely to come to the conclusion that the company is "tight" and that they must look elsewhere.

—A. F. GUYLER, *England.*

Shop Visiting for the Foreman

HAVING worked for a company that made it a point to send their key men about the country observing methods of others, I can say that the good to be obtained from such trips is usually secured in the same ratio as the effort and observation put forth by the individual. If the man making the trip will keep his eyes open and ask questions, he cannot help but derive new ideas from seeing how the other fellow does things. Staying in one shop year after year, and knowing only its way, has a tendency to give a man a warped view of things.

After a company has spent money on a foreman in order that he may become further educated by it, he can't help but feel tied a little closer to the management. It is evidence on the part of the management that it wants the men to broaden and learn in order to keep abreat.

—ARTHUR A. MERRY.

Getting to the Big Boss

IN MY experience I have met foremen who tell the men, "I will see the superintendent about your complaint." But this is never done, and the failure of the foreman to do justice to the complainant has been the cause of loss of skilled help. This probably would not

happen if the foreman had given the superintendent facts in the matter, or if the hand had been able to tell his story.

A plan which would work fairly well is to eliminate the registering of complaints through the foremen and have a mailbox set up where the complaints can be directed to the manager. —ARTHUR H. PONELEIT.

Shop Visiting for the Foreman

IN MANY shops a foreman has so many details to attend that he does not find time to develop ideas for increasing efficiency and production, or for studying methods. An occasional trip to visit other shops will relieve him of details and give him a chance to apply himself to these problems. He will be keenly observant, always with a view to studying new methods for application in his own work, and through an exchange of problems and opinions with other shop foremen, the plant as a whole will be greatly benefited by such trips. The expense of having a foreman leave his shop is negligible compared with the benefits derived by the company.

In some shops there is friction between foremen due to poor work, delay in delivery, or other things, and the superintendent and the other foremen will have opportunity during a fireman's absence of finding out what the other fellow is up against. This will have the effect of ironing out some of the causes for friction and misunderstandings. —A. MCCULLOCH.

Making Good Workmen Out of Poor Prospects

MEN usually do not get raises unless they deserve them and nothing will give them more enthusiasm than to have their merits so recognized. They will go out and tell all their friends what a white concern they are with and at the same time they will work harder in order to show their appreciation. The company in the end profits by a bigger return on its investment since the raise is usually in recognition of past performances rather than for future services.

Systematic raises for everyone are not usually profitable for the firm. These raises are usually small and become a habit with the workers. A good solution would be to give all employees to understand that raises will be due at certain intervals under the condition that they are merited. Good workers are frequently lost because the firm fails to recognize them or show its appreciation and the men are too proud to ask for their just deserts. Personality should not enter into the wage question. —MORTON W. WALTERS, *Designing Engineer.*

Making Good Workmen Out of Poor Prospects

ONE of the best methods of getting workmen to remain with a company is to let it be known that their pay will voluntarily be raised when their services are worth it. It may be needless to add that the workman expects this promise to be kept. It is the hope of every employee that the foreman will see in him possibilities for future development. From the very first day's work it is his desire to make good. Many a good mechanic has been discouraged by the lack of appreciation shown by his immediate superior.

The man's personal appearance, his dress, his attitude towards the work are all factors which help to determine his popularity. The chances for a grouch are very much against him even though his work is better in quality and quantity than that of his shopmates. It is no reason for withholding a raise, however. No deserving mechanic should have to ask for a raise in pay. If he does, there is something wrong. If the foreman is broadminded and believes in personal development he will see that the worthy men working for him receive their just compensation.

—F. W. MIERKE.

Should Foremen Accept Presents from the Men?

IN MY opinion, there is only one time when a foreman is in a position to accept a present from his men, and that is when he is leaving the department to take up a new position. If accepted at other times, the feeling is bound to exist that he is under certain obligations. The only present that should be given and accepted at other times is a whole-hearted respect and support.

—S. A. BURBEY, *England.*

More About Discipline in the Shop

I HARDLY believe that Al's plan of temporarily demoting the cocksure workman is practical in most cases, but I do think it can be applied where the man has thoroughly demonstrated his ability over a long period of time and for some unexplainable reason suddenly goes stale.

It does not seriously conflict with Al's previous idea of saving a man's face because it is a special case and hardly a general policy to be frequently followed. If you are reasonably sure of its success in the particular case, it saves the man to your department. Saving him is better than transferring or firing him.

I have tried Al's plan and found that it works in about three out of four cases. In the case of the failures, which are registered by the man's quitting, I feel that I have given the man every opportunity to find himself and to snap out of it and that his failure is his own rather than the result of error on my own part.

—E. J. GORMAN.

Making Good Workmen Out of Poor Prospects

SOMEHOW Al always seems to be right and I have to agree with him again especially in the statement that a small voluntary raise goes further than a large raise that is asked for. Asking for a raise always leaves a bad taste in a man's mouth. Most people hate to ask for more money and even after they get it, it doesn't give them a thrill.

I would not advocate the continuous raising of a man's pay indefinitely because each job is worth just so much compared with the others, but be sure that your men are getting all that they are worth and then watch for opportunities to make promotions. If the boss can't see a man's worth without being told about it you can't have much respect for him and it leads to that "What's the use" attitude which is the worst thing that can happen. These discussions are a mighty good thing and I feel sure that they will help fellows like Schimmel and Ed, both. —J. C. P. BODE.

Ideas from Practical Men

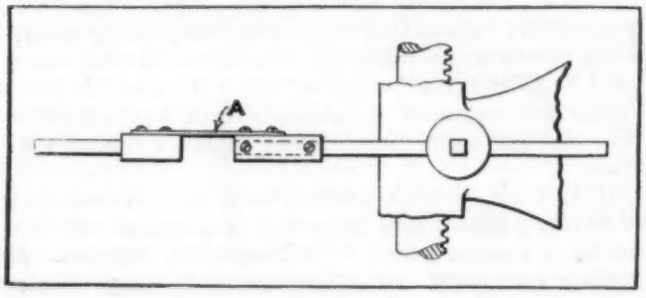
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

A Sensitive Attachment for the Drill Press

BY CHARLES KUGLER

In drilling holes $\frac{1}{16}$ in. or under in the ordinary drill press, there is considerable danger of breaking the drill because the operator is not able to feel what the drill is doing.

A cheap and reliable device to render a drill press more sensitive is shown in the illustration. The feed lever of the drill press is removed and the lever shown



Feed lever that will make the drill press more sensitive

is put in its place. This lever is made in two parts that are connected by a flat spring at *A*. It will readily be seen that the amount of pressure at the drill point is controlled by the stiffness of the spring and its relative position in regard to the feed pinion and the hand of the operator. Thus, due to the flexure of the spring, if the lever is positioned so that the spring is close to the feed pinion, a given force at the end of the lever will cause less pressure at the drill point than if the spring is farther away from the pinion.

A Fixture for Threading Thin Rings

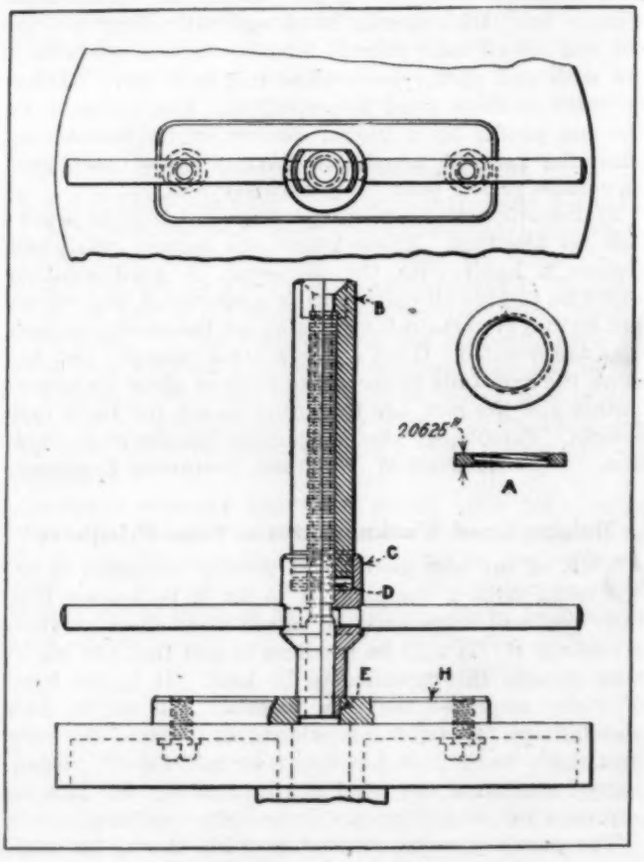
BY HENRY SIMON

A large number of the rings shown at *A* in the illustration, accurately turned and faced to $\frac{1}{16}$ in. in thickness and tapped $\frac{1}{2}$ in.-24 threads, were to be made. What made the job something of a problem was that the requirements for the actual length of the thread had to be practically equal to the thickness of the ring; also, that there could be no appreciable burr; and that the thread itself had to be absolutely clean in order to allow the ring to be set up properly by the limited frictional hold presented by the diameter.

The only practical way of finishing the rings on the automatic involved recessing them opposite to the cutoff by using a swing tool, and this plan was first tried but was later abandoned in favor of the method here illustrated. This method proved more advantageous for several reasons, chief among which were the smaller amount of time required per finished piece, and the greatly reduced waste of stock, as well as the lessened cost of inspection.

The fixture, which would hold about 100 pieces at a time, consisted of a heavy tubular body *B*, in the bore of which the rings were a loose sliding fit. Near the upper end of the tube the bore is reduced to a diameter that will just take the tap easily. A funnel-shaped depression at the top serves as a receptacle for oil. The sides of the tube are slabbed off in order to allow it to be held in a vise while putting in the work and securing it.

At the lower end the tube is threaded externally to take the head *C*, which clamps the rings in place by means of the bushing *D*; being provided with two stout handles that serve both for tightening it in place and for holding the fixture against rotation while tapping the work. Internally the bore of the head is recessed for one-half its length to prevent the fixture from becoming choked with chips, while for the remainder of its length the head is reduced in diameter, ending in a



A fixture for tapping thin rings

short shouldered portion *E*, made to fit freely in a hole in the cold-rolled steel guide plate *H* which is clamped to the table of the drillpress.

To load the fixture, the number of rings required to fill the tube is strung upon a rod that fits their bores closely, and this string is inserted in the tubular body of the fixture. The tubular body is then placed in a vise and the head *C* is screwed on tightly by means of the handles. Accurate alignment being assured by the guide plate, the operator may allow the jig to rotate with the drillpress spindle whenever it is apparent that the tap is under too much strain, thus preventing breakage.

The principal advantage gained by the use of the fixture is that it practically eliminates the necessity for inspecting the threads. When the tap has been run entirely through the string of rings in the fixture, there can be no question but that each ring has been tapped properly. A visual inspection, supplemented by the trial of an occasional ring on the gage, is all that remains to be done.

Keeping Track of Locomotive Repairs and Delays

BY J. MADDEN

The check-up sheet used in the schedule and routing system at the Los Angeles, Calif., shops of the Southern Pacific is shown in the illustration. This form is concerned with one locomotive only, and serves to show the shop history of that locomotive from the time it is brought in for repairs until it goes out into service.

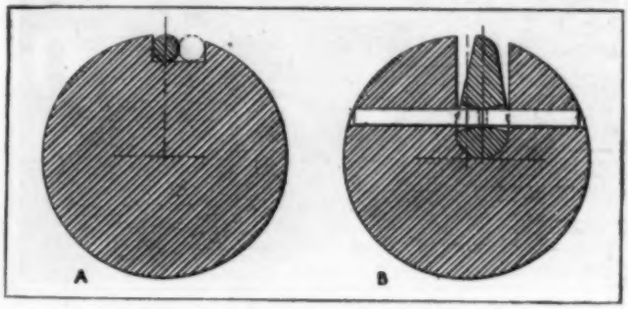
Each department has its own schedule board arranged to take care of the notations necessary to cover the repairs for several locomotives. These boards show the schedule time and the department causing delay, and refer to individual departments only. The information is taken from them periodically by the general erecting foreman or the general shop foreman. Thus they are enabled to know how far the repairs on any locomotive have progressed at any time.

When one department has delayed another, a memo is sent by the general forman concerned to the foreman of the department at fault asking for the causes of the delay. These memos, with the causes stated, are returned to the general foreman, and become parts of the repair history.

A Self-Gripping Arbor

BY H. KLINE

For facing work, the roll arbor, as shown at *A*, is a most effective driver. However it has one disadvantage, in that the operator generally has to hold the roll with one hand when placing or removing the work. To overcome this objection, I designed the arbor shown at *B*.



Arbors that grip the work automatically

This arbor drives by means of a finger that is forced backward by the rotation of the work.

The finger should be so located that its tip describes an arc, the tangent of which forms an angle of about 6 deg. with a line parallel with the holding pin.

Shop Work Schedule, Erecting Gang (A, B or C)..... Foreman..... Class Repairs..... Eng. No.....

Schedule Time ○
Delay by ○

Pit No.	Date in shop	Stripped	Material delivered	Frames	Cylinders	Shoes and wedges	Guides and pistons	Boiler	Boiler fittings and studs	Hydraulic test	Units and steam pipes	Steam test	Cab and running boards	Air pump and feed water heater	Lagging and jacket	Cab fixtures	Pipe work	Electric work	Deflecting plates	Fire pan	Brick work	Oil burner	Wheels	Trucks	Rock shaft and boxes	Reverse shaft and boxes	Spring rigging	Booster	Motion work	Engine wheeled	Valves set	Side and main rods	Brake rigging	Tender	Painting	Out of shop

Boiler Shop = D

Fire box received	Fire box complete	Fire pan and deflector plates	Running boards	Cab

Blacksmith Shop = F

Spring rigging	Motion work	Frames and braces	Running board and pump brackets	Brake rigging	Side and main rods

Machine Gang No. 1 = G

Link work	Reverse lever	Reverse shaft	Throttle rigging	Boiler fittings	Valve bushing	Valves	Cylinder bushing	Crossheads	Eccentrics, straps and liners

Machine Gang No. 2 = H

Brakes and bolts	Pistons	Eccentrics and blade bolts	Spring rigging	Driving boxes	Frame braces	Frame bolts	Rock shaft and boxes	Reverse shaft boxes	Shoes and wedges	Rods and brasses

Motion Work = M

Reverse lever and quadrant	Throttle and rigging	Reverse shaft and rod	Steam chest valve and rod	Links	Rock shaft

Rod Gang = R

Crossheads	Pistons and rods	Main rods	Side rods

Wheel Gang = L

Tires, journals and crank pins	Wheels, boxes and eccentrics	Trucks

Steam Pipe Gang = S

Dry pipe and throttle box	Header and units	Steam pipes and exhaust

Pipe Shop = N

All pipes stripped	Iron pipes applied

Copper Shop = J

Boxes lined and babbitted	Jacket and lagging stripped	Jacket and lagging applied

Foreman must mark his board with ● check (Y) to show work completed and with symbol to show department responsible for delay

Air brake = O
Carpenter = X
Electric = E
Paint = P
Tender = T
Welder = W

Shop Schedule Report
Los Angeles, Calif. Mar. 25, 1925
Shop Sketch
SDPM 1411

Record of shop work schedule and delays

Unwheeling Truck

By J. Monroe

Use of a six-wheel unwheeling truck in the shops of the Great Northern Ry. at Delta, Wash., is shown in the accompanying illustrations. In Fig. 1 it is shown applied to the rear end of the locomotive and in Fig. 2 to the front end. The second illustration shows also, the Great Northern's method of mounting the air pumps

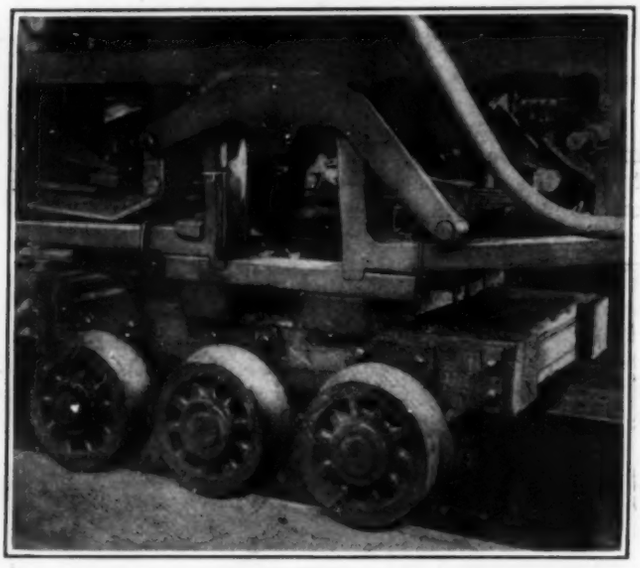


Fig. 1—Unwheeling truck under rear end of locomotive

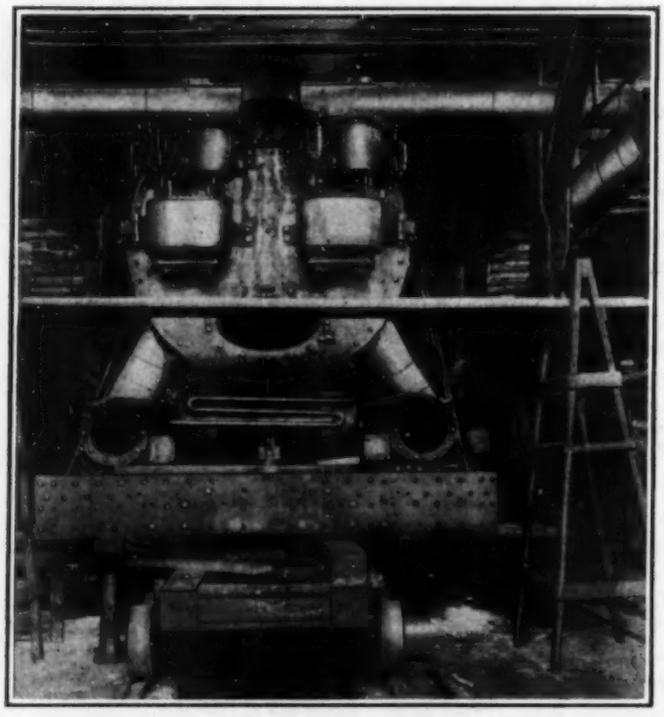


Fig. 2—Unwheeling truck under front end of locomotive. Also air pumps mounted on end of smoke box

on the end of the smoke box, where they will not interfere with the vision of the men in the cab. The air lines can be disconnected easily and the pumps can be swung outward on the hinges provided.

Practical Shop Problems

Questions of a Practical Nature will be answered in this column

Angle of Flat-Head Screw Heads

Q. Please give us the correct angle for the angle of heads of flat-head cap screws. This angle is variously given in handbooks as 70, 80, and 82 degrees.

A. Both 80 and 82 deg. are in common usage, and standard countersinks are on the market for both angles. We understand, however, that a new set of standards to be issued shortly by the S.A.E. will designate the angle on this class of screw head as 82 degrees.

Disk Clutches for Machines

Q. In the design of a machine tool we contemplate the use of a multiple disk clutch, this clutch to be used on the quick return. We have used the formula hp. $= \frac{nfPRN}{63{,}025}$, *in which* n *equals the number of pairs of rubbing surfaces,* f *is the coefficient of friction,* P, *the axial pressure,* R *the mean radius of the rubbing surfaces, and* N *the number of revolutions per minute. The clutch will be used for approximately 4 hp., and will operate at speeds up to 300 r.p.m. Using this formula we get entirely too many disks. Can you give us any information on the subject?*

A. The formula is correct with the exception that *n* is the number of friction surfaces, or one more than the number of disks. You may appear to get too many disks for the reason that the r.p.m. are low. You will note that if the speed were twice as much, you would have only half the number of disks to get the same result. In other words, horsepower varies directly with the speed, and the braking effect of the disks increases directly with the speed. You can, of course, cut down on the number of disks by increasing the diameter.

Another source of error may be in the figure which you have assumed as the coefficient of friction. This coefficient for a good impregnated asbestos disk or lining may be as high as 0.45, and it is important, therefore, that you decide in advance on what lining or disk you will use. Molded disks and special linings are made especially for machine clutches.

Eliminating Spinning of Cables

Q. Is there any method by which the spinning action of a hoisting cable can be eliminated? We have an electric hoist fitted with a braided cable attached to an eye. This hoist lifts material through a hatchway a distance of about 30 ft. When a load is raised the cable twists, causing it to rotate and endangering the operators.

A. The spinning action of the hoisting cable can be largely eliminated by using a "non-rotating" cable, and by making sure that the action does not occur in the socket or eye.

The ordinary cable is made up of 6 strands, with 7, 8, 19, or more wires per strand, and usually with hemp center. It has either right or left "lay," that is, the strands are wound either right or left hand. "Non-rotating" cable has two layers of strands about the core, one wound right hand and the other left hand.

Industrial Lighting Factors

Adequate and well applied lighting is indispensable to successful plant operation, and good illumination will promote safety, reduce spoiled work, increase production and better the morale of employees.

Direct glare is generally bad lighting, and reflected glare from polished surface is annoying. The eyes are naturally sensitive to light coming from below. Where work is being done on shiny surfaces precaution must be taken to choose a unit which softens the downward light by diffusing it.

Shadows are essential to show objects properly in relief. Favorable appearance of the lighted room is important, since workmen prefer to work in surroundings that are pleasing and agreeable. Illumination of vertical surfaces is also important in the shop.

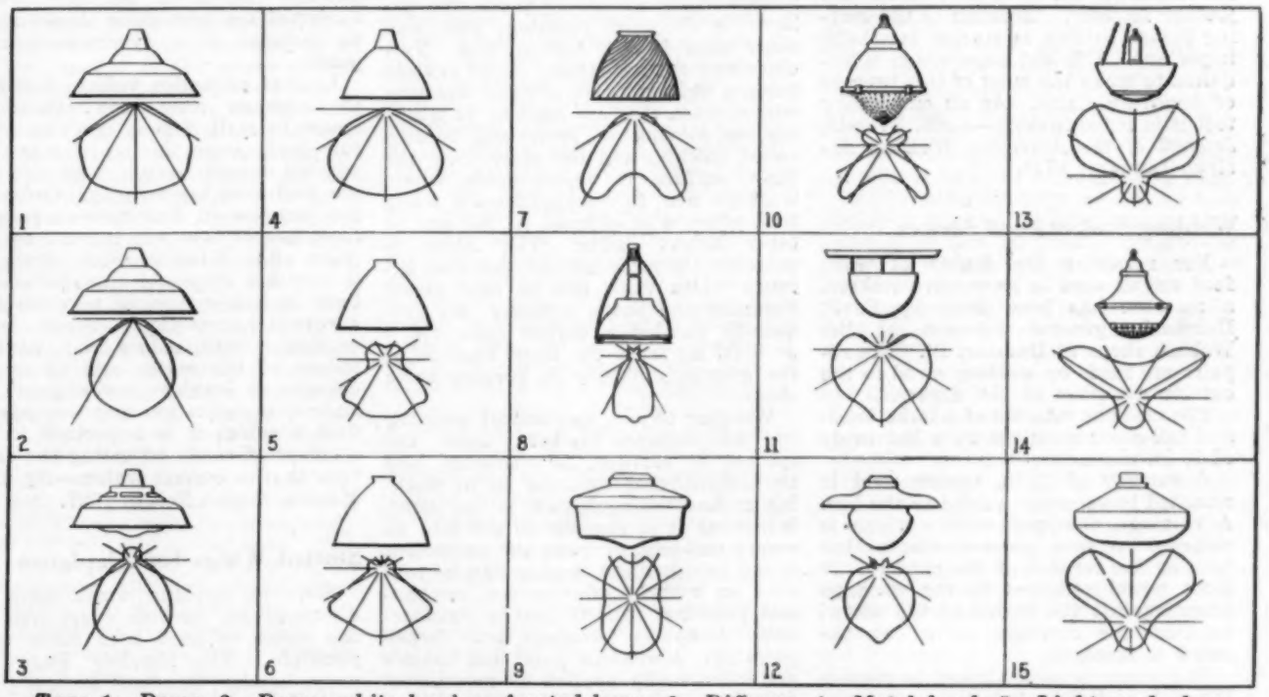
A certain portion of the light is reflected back from the objects upon which it falls, the remainder being absorbed. If the walls and ceiling are light in color they will reflect much of the light, and this will eventually reach the working area. Indirect lighting systems are unsuited to rooms with dark ceilings. Any collection of dirt on lamps or reflecting surfaces will absorb the light and reduce the illumination. Care must be taken to choose a lighting unit that is capable of being cleaned easily, and in all industrial plants a system of cleaning should be provided.

The distance of the light source above the floor depends on the ceiling height or on the overhead shafting. In general it is desirable to mount the units as high as possible to keep the source of light out of the field of view, and to avoid dense shadows.

Even illumination is obtained with the maximum spacing for a given mounting height. Too great a spacing, however, will cause heavy shadows and unevenness of illumination. Spacing is also determined by the arrangement of machines and work, and by the position of columns. No formula can be applied to the spacing of lights in an industrial plant. With indirect lighting the spacing is wider than with direct lighting, since the ceiling becomes the chief source of the light, and there is greater diffusion.

Where high intensity of light is required, local lighting in conjunction with general illumination is desirable, but a light source for each working position is otherwise not effective. Local light is a source of eye fatigue, and a cause of accidents.

Lamps without reflectors waste power, and are the cause of eye injury. In the accompanying chart is shown the reflecting action of the common types of reflectors. For general lighting a portion of the light should always be transmitted upward. This produces more cheerful surroundings, and promotes safety. Where floodlighting is employed in shop yards workmen must not be placed facing the light. On inspection work, where it is necessary to have a light of a color approximately daylight, special lamps with filter plates are available commercially.



Type 1—Dome, 2—Dome, white bowl or frosted lamp, 3—Diffuser, 4—Metal bowl, 5—Light opal glass, frosted lamp, 6—Dense opal glass, frosted lamp, 7—Mirrored glass, 8—Prismatic, 9—White glass globe, 10—Prismatic enclosing, 11—Semi-enclosing, opaque reflector, 12—Semi-enclosing, glass bowl and reflector, 13—Open semi-indirect, 14—Dust tight semi-indirect, 15—Dust tight opalescent

For the information given we are largely indebted to the Edison Lamp Works, General Electric Co.

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Technical Abstracts

The Removal of Risers in the Steel Foundry

The four methods in general use for removing the risers from steel castings are: By flogging or sledging; by the sprue cutter; by the cold saw (high or low speed); by the gas cutting torch. Determination of which method to use in a given case depends on the size of the head, the shape of the head, the regularity of junction line between head and casting, the size and design of the casting and the material in the casting (high or low carbon steel, or alloy steel), the speed of the process, accuracy, cost per square inch of metal severed, supervision required, size of remaining stub, adaptability to the job.

In castings of normal carbon steel, 15 to 40 lb. in weight, the heads can best be removed by flogging. The flogging chisel is often of great assistance. The cost of equipment is low and labor cheap. For smaller heads with necks not exceeding 1¼ in. in diameter the sprue cutter is used to advantage. The high-speed saw is used for the same type of work but is generally less economical. The slow-speed saw is useful in removing risers from die blocks, rolls and similar heavy, chunky pieces.

For general use in both large and small work the gas torch is popular. Its versatility makes it suitable for the jobbing foundry. Cleaning of the casting before cutting is started is vitally important. Efficient supervision is required to make the most of this process of removing risers. As an emergency tool it is indispensable.—L. E. Everett, *Journal of the American Welding Society*, January, 1927.

Welding Stoker Feed Screws

For repairing the flights of worn feed screws used in locomotive stokers, a machine has been built by E. J. Hausbach, general foreman of the Wabash shops at Decatur, Ill. The repairs are made by welding a rod to the outside diameter of the flights.

The machine consists of a lathe head- and tail-stock mounted on a bed made of 10-in. channels.

A runway of 2½-in. square steel is attached to supports welded to the bed. A carriage equipped with a torch is mounted on four grooved wheels that bear on the corners of the runway. A loose wheel attached to the carriage bears against the flights of the screw, so that the carriage moves as the screw is revolved.

The screw is sand-blasted to remove the scale and dirt. It is then put in the lathe and is measured to determine the amount of metal to be removed to obtain a good foundation for the addition of the metal to bring the flights to the proper diameter.

After the flights have been trimmed, a bar is formed to fit them by heating it with an acetylene torch mounted on the carriage, the screw being slowly rotated. The bar is hammered into position before the screw is removed from the machine.

Welding is done by the electric process with the screw standing on end, since more progress can be made than if it were lying horizontally. It is also easier on the operator. The time for repairing a screw averages about seven hours.—James G. Heaton, *Railway Mechanical Engineer*, February, 1927.

Painting Practices in Industrial Plants

In plants suffering from defective production due to carelessness and poor light, cleaning and brightening up the interior will improve the quality of the workmanship. Poorly kept surroundings are commonly reflected in a slovenly attitude toward production. Although it is difficult to measure direct returns from painting and cleaning, the management in practically every case after a shop is brightened up attributes at least part of the improvements in quality and quantity, as well as a better attitude of the workers, to the improved appearance of their surroundings.

The value of white paint for ceilings is so well recognized by those who believe in frequent painting, that any other color is now seldom used. Two objections are sometimes raised against using a light color on a wall. Sections within reach that are exposed to trucking and moving of materials, become soiled quickly; and the glare from the light surface is objectionable where workers are forced to face a white wall when it is exposed to the sun or other bright lights. The latter is probably the more serious objection because white walls can be kept clean. Columns and posts, however, are frequently painted a darker color for 4 or 5 ft. up from the floor, because of the greater difficulty in keeping them clean.

Whether to use mechanical painting or not depends largely upon the amount of surface, its character, and the difficulty of covering up or working around the equipment in the plant. Whenever it is possible to get into an empty building, or when the equipment is not in operation, and so can be covered up without interference, mechanical painting, usually, has a considerable economic advatage over brush painting. Aluminum paint and lacquer are more easily applied by mechanical painting equipment than by brushing. Trimming and painting of pipes and similar work is usually done most economically by hand painting. This method is almost essential where the paint used is of a different color than the background.—By Frank E. Gooding, *Industrial Engineer*, February, 1927.

How Synchronous Motors Are Started

At the present time, control equipment for synchronous motors may be classified as manual, automatic and semi-automatic. With a typical reduced-voltage manual control the proper time for each operation is left to the judgment of the operator who should be competent and skilful. The full voltage, automatic starter and the reduced-voltage starter are operated by push-button stations that may be at points remote from the starting equipment. With this type, the operator merely presses a start button that in turn controls the automatic starter. The semi-automatic starter is a compromise between the manual and the automatic starter. In using this type the operator starts the motor on reduced voltage then changes to full-voltage connections at the proper time.

Two main types of overload relays are used for ordinary industrial service. The inverse-time type is set to trip at a definite sustained current, and will trip more readily as the overload increases. The thermal type carries a current proportional to the load current, and the time required for the relay to open depends on the rate at which heat is transferred from the heating element to the thermostatic element that trips the main switch. Undervoltage protection should always be included in a synchronous motor panel.

Loss of excitation voltage will cause the average slow-speed synchronous motor to stall if it is carrying nearly full load, since the starting winding will not develop enough torque to carry the load even temporarily. Ordinarily, the increase in line current resulting from loss of field will trip the overload relay. But, if the character of the load is such that the motor may operate with light loads, the overload may not afford adequate protection. Since under-excitation will reduce the maximum torque of the motor and cause it to operate at lagging power factor, and since over-excitation may overheat the field winding, it is important to have a means of easily adjusting the excitation to the correct value.—By R. M. Matson, *Power*, Feb. 8, 1927.

Slotted Wings for Airplanes

Slots in airplane wings have been discussed for several years but little use seems to have been made of the principle. The Handley Page Company, London, has built several planes, both biplanes and monoplanes, using the slotted wing and has secured interesting results. The use of this type of wing decreases the length of run necessary in landing a plane and also enables a short take-off run.

The wings are of the normal type with flaps extending along the entire

trailing edge. The outer extremities of these flaps are capable of being operated separately as ailerons. When the flaps and ailerons are depressed a slot at the hinge opens automatically, permitting the airflow to pass through and over the upper surface of the flap. The leading edges of the wings also have a slot the entire length and form single, mono-surface airfoils. This leading slot also opens and closes automatically with the use of the ailerons. The inner sections of both the trailing edge flap and the leading edge slot in each wing panel are operated by the pilot as a separate control, for changing the lift coefficient of the wings.—*Aviation*, Feb. 14, 1927.

Preparation of Surfaces for Japanning

In preparing metal parts for japan finishing it is necessary that they first be thoroughly cleaned. A great variety of metal parts made of steel, iron, brass and aluminum are sent to the finishing room in the form of stampings, castings and forgings. Stampings with folded seams are difficult to japan because the oil inclosed in these seams will boil out when the japan is baked on, unless previously removed.

The removal is accomplished by baking the parts in the same or another japanning oven at a slightly higher temperature than that for the japanning or by using hot chemical compound solutions. The baking method is usually used for large parts. The small particles of oil and grease are said to crystallize on being heated after which they loosen easily and fall off in the form of dust. Care must be taken to wipe off this dust even on the surfaces where a high finish is not required so that the dust will not be washed off into the japan. If the parts are allowed to get too hot they are likely to become warped, especially if they stand in piles. If this process is used on lead-coated metal which is acid resisting the high heat is likely to cause the lead coat to disappear entirely or to leave small metal pockets in the lead-coated surface to which the acid adheres more readily than it does to uncoated steel.

The chemical compound method of metal cleaning is used for small parts that can be handled in bulk but should not be used where solder is present. Benzine is also extensively used to clean surfaces but it is injurious to the workman's hands. He should always wear rubber gloves for the latter process. Commercial sulphuric acid in diluted form will instantly remove surface rust. In using the acid process, the surplus acid should be immediately washed off in a hot water bath. The parts should then be plunged in an alkali cleaning bath and rinsed again after that. This sulphuric acid treatment should not be given until the japanner is ready to follow it immediately with a coat of japan.

Another efficient process for cleaning parts is sandblasting. Tests recently made showed that a constant pressure of 60 lb. per sq.in. and a fixed distance of 8 in. with an angle of application of from 40 to 60 deg. were most efficient for this work.—W. J. Miskella, *Fuels and Furnaces*, February, 1927.

Turbine Locomotive for the German State Railways

The second turbine locomotive recently delivered to the German State Railways develops 2,500 hp., and is designed to haul heavy express trains at an average speed of 62 m.p.h. and at a maximum speed of 78 m.p.h. The general design and construction follow as far as possible that of the Pacific type engines adopted by German State Railways. The diameter of the driving wheels is 68.8 in. The total weight is 229,000 lb., of which 132,000 lb. is carried on the drivers. A steam pressure of 324 lb. is carried. Because of the high pressure and the saving of steam by the condensers, the boiler has been made shorter than is usual, thus giving room for the turbine and the reduction gearing. The power from the turbine shaft is transmitted by two pinions through reduction gearing to a jack shaft, and from thence to the main connecting rods and the six-coupled driving wheels.

Two surface condensers are located at the sides of the boiler, the air being removed by steam ejectors. Condensate water is removed by a pump connected to the feedwater pump. The tender is longer than the standard, allowing room for the turbine that drives the air fans, the circulating pump, and the spray cooling system. Of the coal consumed, 15.6 per cent of the total heat energy can be utilized when running at 43.5 m.p.h., whereas from 7 to 8 per cent is all that can be utilized in the reciprocating type of engines of standard construction.

The forward drive and backward drive turbines are inclosed in the same casing, and are situated above the engine truck. The turbine blades are of nickel steel and are milled from the solid. The turbine shaft is rigidly secured in its bearings and the projecting ends are suitably guided. The pinions are secured to the shafts on taper seats. A gear-driven oil pump, connected to the turbine shaft, draws lubricating oil from the reservoir and distributes it through pipes to the various bearings. Exhaust steam from the auxiliaries heats the feedwater coming from the condensers at from 110 to 120 deg. up to 195-200 deg. F. The water then passes to a second heater where the exhaust from the turbine connected to the cooling-water pump, and part of the time from the suction-draft turbine, reheats the water to about 260 deg. F. A small, high-speed turbine in the door of the smoke box, operates a fan to eject the gases. The fan is made of non-rusting steel.—G. J. Melius, *Railway Mechanical Engineer*, February, 1927.

Welding Battered Rails in Place

The common practice of reclaiming rails that have battered ends involves the removal of the rail and its shipment to a shop where it can be cropped. It also means that the shortened rail is then held in stock until some opportunity arises for using it on tracks of minor importance.

An improved method which does not necessitate taking up the rail has been used by the Southern Pacific R.R. This consists in truing up the battered ends with metal deposited by oxy-acetylene welding. Recent experiments have demonstrated that the work can be done even faster by the electric arc welding process.

As the result of line tests, the company has placed two complete gas engine-driven sets in service. These sets consist of the welding generator, gas engine, grinding generator, and control equipment inclosed in a metal casing and mounted on a truck for rolling on the railroad tracks. Cross wheels are provided for removing the equipment from the track. It has been found that these sets will operate with 750 ft. of cable, which permits 1,500 ft. of track work to be covered without changing the location of the welding set.—M. Rhine and A. V. Thompson, *Railway Electrical Engineer*, January, 1927.

Mass Production as Applied to Moto Meters

In making the Moto Meter the frames are in the form of a die-casting of zinc alloy to which is fitted a brass tube or shank, threaded so that it can be screwed into the radiator cap or other holder. Heat indicators, scales, name plates, crystals and retaining rings complete the assembly.

The glass rods are cut into the proper lengths by steel disks, power-driven, and by means of specially constructed apparatus are selected for size and bore. Each tube is graded according to the size of the bore, numbered and sorted. Each of the 100 lots of the selected tubes requires a different size bulb. In the glass-blowing department there are 40 gas burner sets and 20 gas-fired glass tube heaters. The burners are of the Bunsen type. In this department the stem tube is cut after the walls are thinned at one point and bulb tubes are melted onto the expanded ends of these stem tubes. Lots of 5,000 are placed together in a steel container and aged for 60 days to remove strains in the glass. They are next filled with the red indicating fluid.

In the latter department small round copper containers holding about 1,000 tubes each are put under glass bells where a vacuum is created to exhaust the air in the tube. The containers are then pumped full of the red indicating fluid which is forced into the tubes by destroying the vacuum and pumping air in under pressure. They are then put through a boiling out process to remove excess liquid and after that the open ends of the tubes are sealed.

In the testing department the units are brought to a boiling temperature of 212 deg. F. and the heat indicator marked at the corresponding point. The eight testing steam pots are so constructed to give the same conditions as those on an automobile traveling at 25 m.p.h. The upper end of the indicator is cooled by an air blast while the other end is immersed in the steam. When they have cooled to a point of 70 deg. F., they are again graduated.

The heat indicating unit is then ready for assembly in the machined frames. Rows of girls on both sides of three successive conveyors take care of the assemblying, wrapping and packing.—Alfred B. Schupp, *Industrial Gas*, February, 1927.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

First Aid to Ideas

SOME people seem to think that ideas are Heaven-sent inspirations vouchsafed only to the favored few. As a matter of fact, there are men who apparently have more than their fair share of brilliant thoughts. But how do they get them? Do they just materialize suddenly out of the ether?

As a rule, ideas of the pure inspirational type are so scarce as to be phenomenal. Most of them result from the train of thought started by the seeing or hearing of something that some one else has done or said. The idea that finally evolves generally has little apparent relation to the thing that started it, often none whatever, but it never would have been thought of without the something that started a brain working.

If this theory is a correct one, and experience bears it out pretty well, isn't it the part of wisdom to expose one's self to things that will start the mental processes? There are various ways of accomplishing this end, of course. Visiting other shops is an excellent way to come in contact with the ideas and accomplishments of a small group of men. Attendance at engineering gatherings enables one to discuss problems with a larger group. Reading technical books and industrial periodicals opens a still wider field but makes the contact somewhat less immediate. All of these activities, and any others that may help one to keep his brain in good working order, should be indulged in unsparingly by the man who needs to have ideas in his business. And who does not?

Stretching the Executive Mind

LIKE most other types of mind, the executive mind is in need of frequent stretching to keep it keyed up and ready for new things. Apparently, the harder the brain is worked the better it functions. At any rate, there are far more brains suffering from lack of exertion than from over-exertion.

Providing the right kind of exercise for the executive mind is not the easiest thing in the world. During the work day it is called upon to pass judgment on many different sorts of questions brought up by subordinates. Some executives are prone to consider this kind of work as pretty strenuous brain exercise but as a matter of fact most questions of this nature can be settled from the executive's experience. He is using his memory rather than doing constructive thinking.

Then, too, the mental exercise obtained from the problems of a man's daily job tends to be monotonous, and exercise to be beneficial, should have variety. Obviously the executive should seek for variety in his brain exercise by digging into other fields in his spare time. Some men have found astronomy a fascinating study, others have profited from reading books on psychology, biology or philosophy. Such books will naturally contain some material that is not easily understandable but that is where their principal value lies, they make the reader exercise his mental powers and by so doing broaden his vision and stimulate his brain to a more efficient functioning.

Going Outside for Executives

GOING outside for executives is as much a reflection on the management of an organization as of the men in it. It may even be a greater criticism of the management that failed to keep a supply of the right kind of executive material coming along to take the places of those who drop out for one cause of another.

There is much talk of "getting new blood" into the concern. And there are many cases where it is necessary. But it is much more rational to keep the body in a healthy condition by proper food, exercise and ideas than to depend on a blood transfusion after it becomes anemic.

Nothing is more discouraging to employees or to the lower executives than to have new men brought in to fill the positions to which they have probably aspired. True, it is frequently necessary, when the management has failed to keep the whole executive body in a state of health. But it is a method that is fraught with danger.

Specifying Results Rather than Details

DIRIGIBLES still provide a subject for hotly disputed arguments, but Naval authorities evidently believe that they should have further trial as they are calling for bids for two of the rigid type. While there may be differences of opinion as to the value of airships, all will agree to the wisdom of naming the general size, and performance desired and leaving the details to the designers and builders.

The gas volume is to be 6,000,000 cu.ft., the length 780 ft. and the cruising radius 6,500 nautical miles at 50 knots, with a possible speed of 70 knots at 3,000 ft. through calm air. The maximum height and width are also given. There is no hint as to the amount of power or kind of engine, which is as it should be.

Shop Equipment News

Moline No. U-68 Rail Drilling Machine

THE Moline Tool Co., Moline, Ill., has developed the No. U-68 drilling machine shown in the accompanying illustration. It is to be used for the drilling of steel rails of all sizes and has a capacity of twenty 1-in. drills in steel.

The table or bed is a well-proportioned box section, thoroughly ribbed, and is used as a reservoir for the cutting compound. Four upright columns, which are also of box section, are bolted to the bed and are further tied together by an 18-in. steel I-beam and a 12-in. steel channel section. In this way it is said that a very rigid structure is obtained for the sliding member which carries the drill spindles. This sliding unit is counterweighted by weights suspended by chains running over sheaves at the top of the machine.

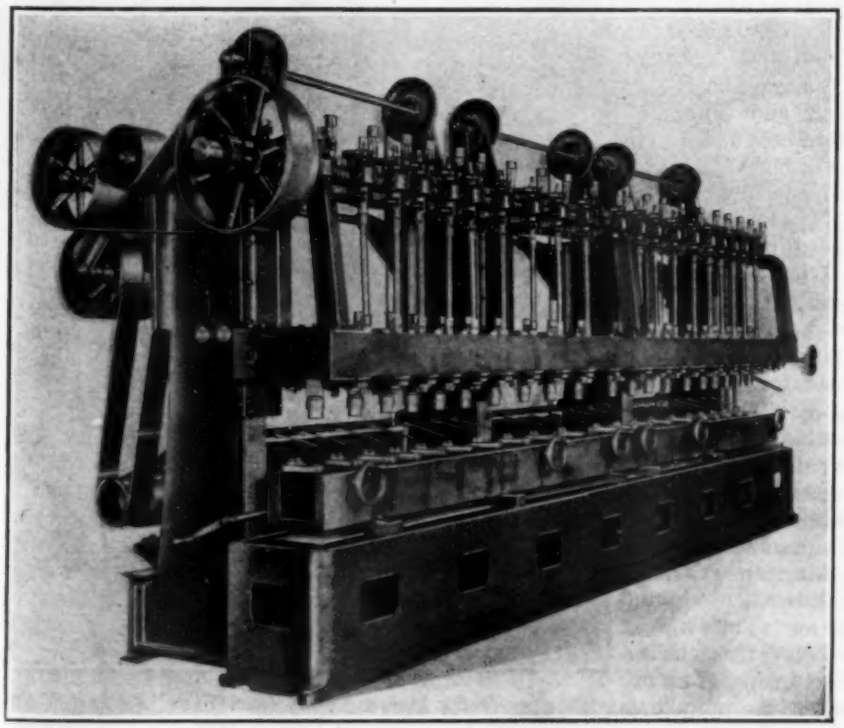
The drive mechanism is located at the left end of the machine. A 40-hp. motor is suitably mounted on the bottom of the machine and is furnished with a two-step cone pulley which is belted up to a similar but larger cone pulley on the countershaft. A wide idler pulley acts as a belt tightener. From this countershaft the power is transmitted through another belt with idler pulley to the main spiral. This spiral is a hardened and ground steel helical screw running the entire length of the machine. The power to each spindle driving head is taken off through meshing 3-pitch spiral gears. Each driving head is laterally adjustable on the upper rail and transmits its power to the pinion shaft of the driven head on the lower rail through a telescoping shaft having universal joints at both ends.

The pinion shaft meshes with a gear on the drill spindle with a further reduction in speed. The drill spindles are fed down together but they have 1-in. independent end adjustment to take care of varying lengths of drills. The feed cycle is semi-automatic. The operator engages the quick traverse clutch and the spindles are brought down to the work rapidly. The feed is then automatically reduced for drilling and when the operation is completed the drills rapidly traverse back to the starting position.

In the illustration a trough jig is shown that has an in-and-out adjustment to care for various sizes of rails. It is equipped with adjustable plates for the drill guide bushings. Six hand-wheels are used to clamp the rail in position.

The spindles have in-and-out adjustment of 3 in. horizontally. The maximum distance between end spindles is 20 ft. 5 in. and the minimum distance between adjacent spindles is 4 in. except for the two center spindles where the center distance is 5½ in. The total vertical travel of the sliding rail carrying the drilling heads is 30 inches.

The machine weighs approximately 50,000 lb. It occupies a floor space of 6 x 23 feet.



Moline No. U-68 Rail Drilling Machine

Société Genevoise Comparator for Small Internal Diameters

The comparator shown in the accompanying illustration is made by the Société Genevoise d'Instruments de Physique of Geneva, Switzerland, for use in measuring internal diameters of small size. It is marketed in this country by the R. Y. Ferner Co., Investment Building, Washington, D. C. The comparator tube or indicator which has a knife-edge multiplication system, is standard, while the support is of special design for handling this kind of work. The support was first developed for the measurement of the internal diameters of very small ball bearings.

The instrument can be furnished to read in either metric or inch units, and while it was originally designed for rings varying from 4 to 6 mm. in diameter (0.16 to 0.24 in.) it could, with slight modifications, be constructed for the measurement of larger rings. Ring gages accurate to plus or minus 0.001 mm. (0.00004 in.) can be furnished with the instrument when desired for the dimension of the ring to be tested.

The support includes a small rectangular table on which the piece to be tested is placed. Projecting from

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this table are a movable and a fixed contact point, the former being fitted within a slot of the latter in order to give sufficient strength for making measurements in holes as small as 4 mm. The movable contact point is suitably shaped for making a proper contact within holes of a range of 1 mm. above and below the normal capacity of the instrument. This contact point is located at one

Société Genevoise Comparator for Small Internal Diameters

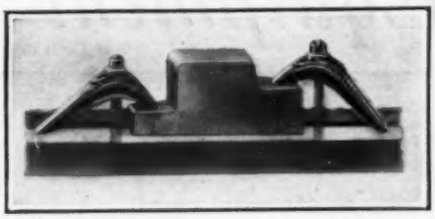
end of a lever arm at the opposite end of which is an adjustable contact point, which bears against the plunger of the test comparator tube. This tube is mounted obliquely for easy reading. These tubes can be supplied to read to 0.0001 mm. or 0.0001 or 0.00005 in. per division.

To make readings on a ring, the contact plunger of the comparator tube is raised by means of a plunger-lifting lever, and a standard ring gage is placed over the contact prongs on the table of the instrument. The test comparator tube is brought to a zero reading by an adjustment of the contact screw bearing against the end of the plunger. Readings on the rings can then be made by substituting them for the standard gage.

Billings Adjustable Strap Clamp

The Billings & Spencer Co., Hartford, Conn., has placed on the market the adjustable strap clamp shown in the accompanying illustration. This universal clamp is designed for holding work on planers, boring mills, drill pressers, faceplates of lathes, and milling machines.

Its design permits the clamp to be used on irregular shapes of various



Billings Adjustable Strap Clamp

sizes without washers and shims. Where the work to be strapped is larger than the capacity of the clamp, it is only necessary to use a block not greater in height than the piece to be strapped.

This clamp has only two working parts to be used in connection with the tiebolt with which every machine is equipped. Since the position of the saddle can be easily changed, the tension between the T-slot of the machine and the saddle (transmitted through the tie-bolt) is always at right angles to the table.

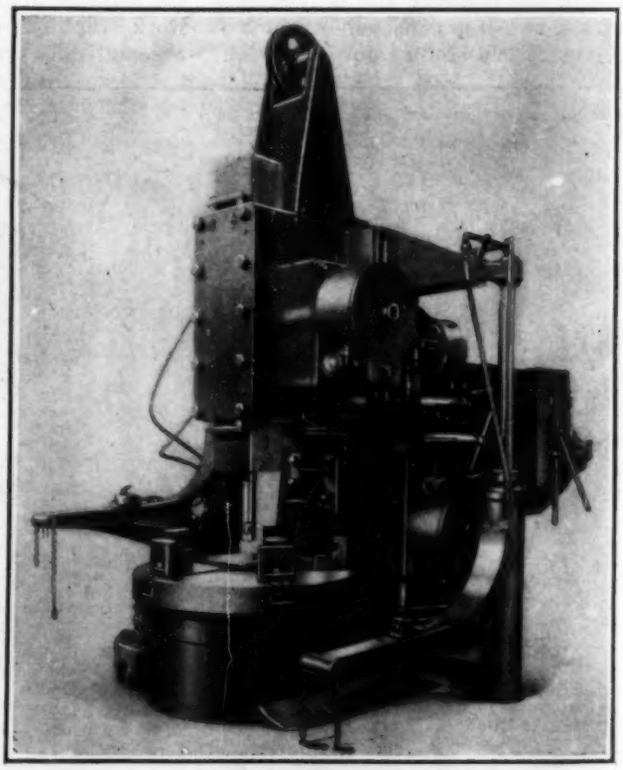
This device is hardened in oil and is furnished in its natural finish. It is made in three sizes.

Betts Extra-Heavy Car-Wheel Boring and Facing Mill

THE extra-heavy car-wheel boring and facing mill shown in the accompanying illustration was built by the Betts Works of the Consolidated Machine Tool Corporation of America, Rochester, N. Y. This machine is intended for the rapid production of rolled- or cast-steel car wheels on a manufacturing basis. It will rough bore and face steel wheels ranging from 20 to 42 in. in diameter.

The chuck is fully automatic in its action and is equipped with five heavy jaws designed to accommodate wheels with the flanges either up or down. It is 52 in. in diam. and is driven by a powerful spur gear and pinion of wide face and coarse pitch. The main drive is furnished by a 50-hp. variable-speed motor having a 3-to-1 speed range and with automatic push-button control. Dynamic braking is used for quick stopping. The vertical boring spindle is made of steel of heavy rectangular section with square guides and shoes for taking up wear. It is counterweighted by means of a weight which enters a chamber in the frame when the spindle is elevated. The horizontal facing spindle is also made of steel of heavy rectangular section and is provided with a sliding support in a square guide so that the tool is always backed up rigidly close to the cutting point. The tool holder has sufficient hand adjustment for tool setting.

Both boring and facing spindles have a suitable range of power feeds through sliding steel gears shifted through levers located convenient to the operator. The spindles also have



Betts Extra-Heavy Car-Wheel Boring and Facing Mill

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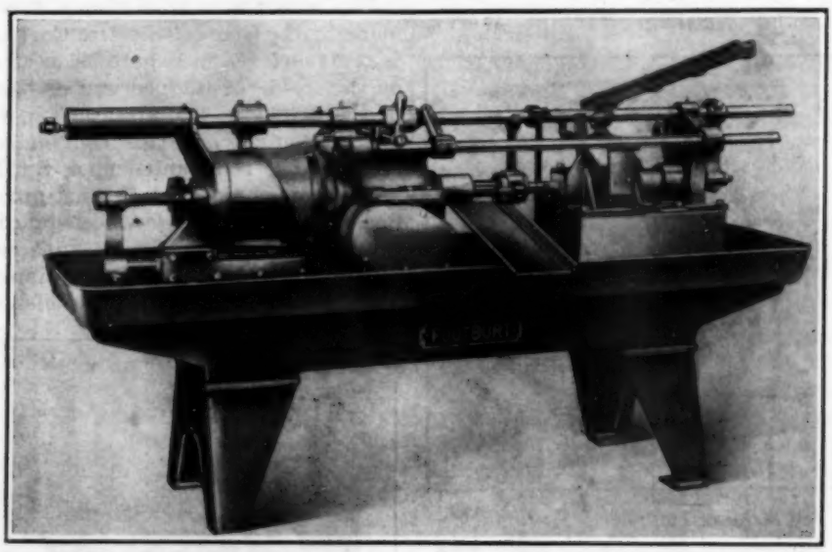
power rapid traverse by means of separate driving motors. The power traverse is so arranged that the feed may be used on one spindle while power traverse is being used on the other and vice versa.

Two pneumatic hoists are used for handling the wheels to and from the chuck. This arrangement allows wheels to be loaded and unloaded on either side of the machine. The hoists may be quickly manipulated as either of them will swing to the center of the table.

"Footburt" Horizontal Automatic Tapping Machine for Pipe Couplings

THE Foote-Burt Co., Cleveland, Ohio, has developed a single-spindle automatic horizontal tapping machine for use on pipe couplings. The machine is manufactured in two sizes, the smaller size for couplings from ½ to 1 in. and the large size for couplings from 1¼ to 2 in., nominal size. It is said that this machine can tap ten ½-in. steel couplings, 1⅞ in. long, a minute, and production is correspondingly high on other work.

The machine is entirely automatic in action and it is only necessary to keep the magazine loaded with couplings. From the magazine the coupling automatically passes through the machine until it is tapped and drops off into a container from a slide. It is not necessary to pass the entire threaded part of the tap through each individual coupling before another coupling can be started. While the tap is completing its course through one coupling it is starting to tap another, two vises being used to hold the coupling.



"Footburt" Horizontal Automatic Tapping Machine for Pipe Couplings

In operation there are always two couplings in the vises and at least one finished coupling on the shank of the tap. All of the actual tapping is done with the coupling in the first vise. As the end of the tap breaks through the coupling, it pushes a bar which trips a drum cam, which in one cycle completes the following operations:

After a piece has been tapped the spindle moves back away from the tap while a stripper attached to it pulls a completed coupling off the shank end of the tap. An unfinished coupling from the magazine falls into place before the first vise. The jaws of the vises automatically release the couplings and when the trip bar returns, it pushes the new coupling into place in the first vise and by so doing pushes the tapped coupling carrying the tap into the second vise. The coupling which was in the second vise in turn is carried back on the shank of the tap to be pulled off by the stripper in the next cycle. The jaws of the vises then automatically clamp. The spindle moves forward to the tap and starts revolving. The tapped coupling in the second vise acts as a lead for the tap in tapping the coupling in the first vise. The cycle is then repeated.

The two vises previously mentioned have three jaws, two stationary and one movable. The movable jaws of both vises are in a vertical position and are controlled simultaneously by means of a cam. When a piece is to be clamped the cam is released and a spring located above each movable jaw forces the jaws down to the clamping position. The direction of the pressure set up by the tap tends to tighten the coupling in the vise. The pressure is no more than is actually required to hold the coupling and, therefore, the piece is marked very little by the vise.

Milwaukee Milling Machines with Roller Bearing Spindles

The Kearney & Trecker Corporation, Milwaukee, Wis., is now regularly furnishing ten models of its larger size Milwaukee milling machines with the main spindles mounted on Timken tapered roller bearings. This application is in addition to the several Timken roller bearings used in the gear train leading up to the spindle.

In the cross-sectional view, a large roller bearing is shown at the front of the spindle. Its cone or inner race is pressed tightly on the shaft, and the cup or outer race is pressed directly into the heavy metal of the column front. Lubricating oil constantly flows in at the rear of the bearing, is passed through by the action of the rollers and is returned to the column from a pocket at the front. Oil slingers are provided to prevent the escape of the lubricating oil, and also to prevent the entrance of cutting compound into the bearing.

For the rear mounting, the cup is also pressed directly into the column casting, and the cone pressed onto a long sleeve which is keyed to the spindle, but is free to slide endwise for adjustment. The adjusting nut is at the rear of the spindle in an accessible position.

Initial thrust load is placed on the bearings when they are adjusted at the factory, in order to insure the

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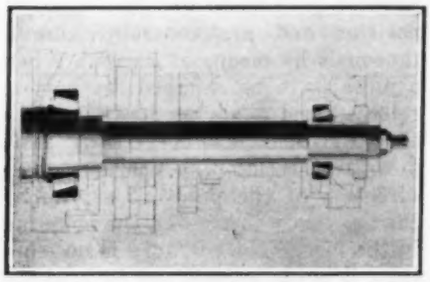
spindle operating without further adjustment for a long period of time. The bearings themselves are especially manufactured and selected. The maximum allowable eccentricity is one-quarter of a thousandth of an inch.

The adjustment of the spindle is practically self-compensating for



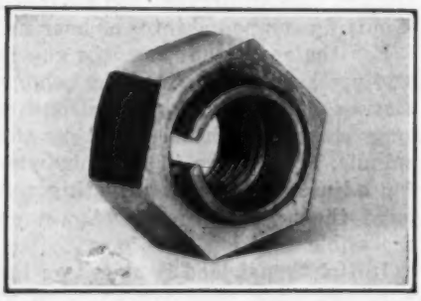
Spindle of a Milwaukee Milling Machine with Timken Tapered Roller Bearings

changes of temperature. Initial adjustment is made at room temperature and due to the angle of the races, as the parts heat up in operation, they increase in diameter at a slightly greater rate than that required to compensate for any looseness caused from the spindle expanding at a greater rate than that of the column side walls. The bearings, therefore, become slightly tighter at higher speeds and do not become loose as might be expected. This tightening, however, is never enough to impose excessive load on the bearings, if the initial adjustment is properly made.

"Lafever" Locknut

The "Lafever" locknut illustrated is made by the American Locknut Co., Longview, Wash., for all kinds of machinery and railjoints where vibration is present.

As shown, the locknut consists of a standard hexagon nut countersunk



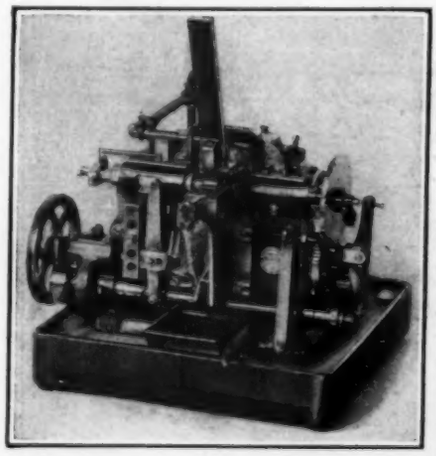
"Lafever" Locknut

on the underside to accommodate a soft copper ring, which partially projects from the nut. The principle of the locking action is that the soft copper flows into all the space around the recess in the nut and between the threads of the bolt and nut where it hardens due to the work performed upon it. The surplus copper is forced into any available space around the bolt in the hole in the frame of the machine and prevents side motion of the bolt. The copper remains under pressure until the nut is backed off, when it is destroyed.

In addition to locking, this copper piece forms a metal gasket that is steam or watertight and is non-corrosive.

Waltham Improved Automatic Pinion and Gear Cutting Machine

A magazine feeding mechanism has been added to the 1½-in. pinion and gear cutting machine shown in the accompanying illustration, made by the Waltham Machine Works,



Waltham Improved Automatic Pinion and Gear Cutting Machine

Waltham, Mass. The machine itself was previously described on page 718, Vol. 62, of the *American Machinist*.

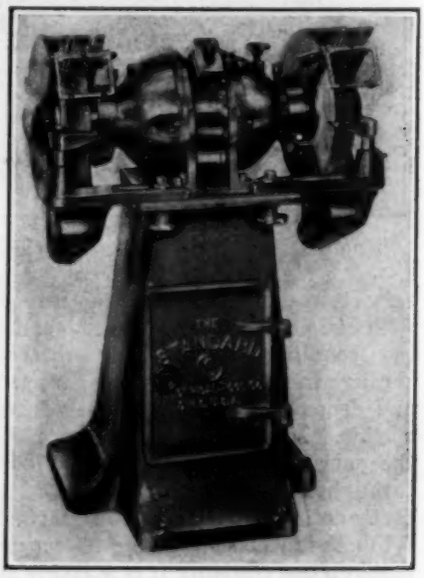
The magazine feed is for cutting solid or hollow pinions on a high-production basis. With this feed it is only necessary for the attendant to place the blanks in the track of the magazine. Thereafter the operation is automatic. When a blank has been completely cut, either with a single cutter or by using two or three cutters, the magazine operating mechanism is brought into action: the motion of the main camshaft is stopped, the tailstock spindle is withdrawn and the cut pinion ejected, after which a blank from the magazine is brought into position and gripped. The main camshaft then begins to revolve again.

All these operations are performed in less than one second, so that the time gained through the use of the magazine is nearly equal to all of that required to change the work by hand. Besides this advantage of time, one operator can care for a larger number of machines than would be possible with the hand-feeding type.

Standard Electrical Tool Co. Motor-Driven Floor Stand Grinder

The Standard Electrical Tool Co., 1938 West 8th St., Cincinnati, Ohio, has placed on the market two motor-driven floor stand grinders, one of which is illustrated. These are 3 and 5 hp., respectively.

The motor used is a 40-deg. type, made by the General Electric Co. and is controlled by push buttons located on the inside of the pedestal or base of the grinder. The armature shaft is made out of a 3½ per cent nickel steel, and it is mounted upon S K F ball bearings, incased in dust-proof housings. The emery wheel guards are of the hinge-door type with exhaust connections. They are equipped with spark arresters and polished



Standard Electrical Tool Co. Motor-Driven Floor Stand Grinders

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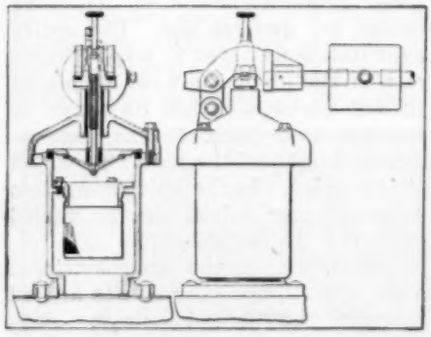
wired glass eye shields, which are adjustable.

The 3-hp. grinder carries emery wheels 12 and 14 in. in diam. and with a 2 in. face. The larger machine has emery wheels 18 in. in diam. by 3 in. face.

"Ventex"

The Midwest Steel and Supply Co., Inc., Bradford, Pa., is marketing a device, called "Ventex," for preventing explosions in storage tanks holding volatile and inflammable liquids. The industrial type is shown in the accompanying illustrations.

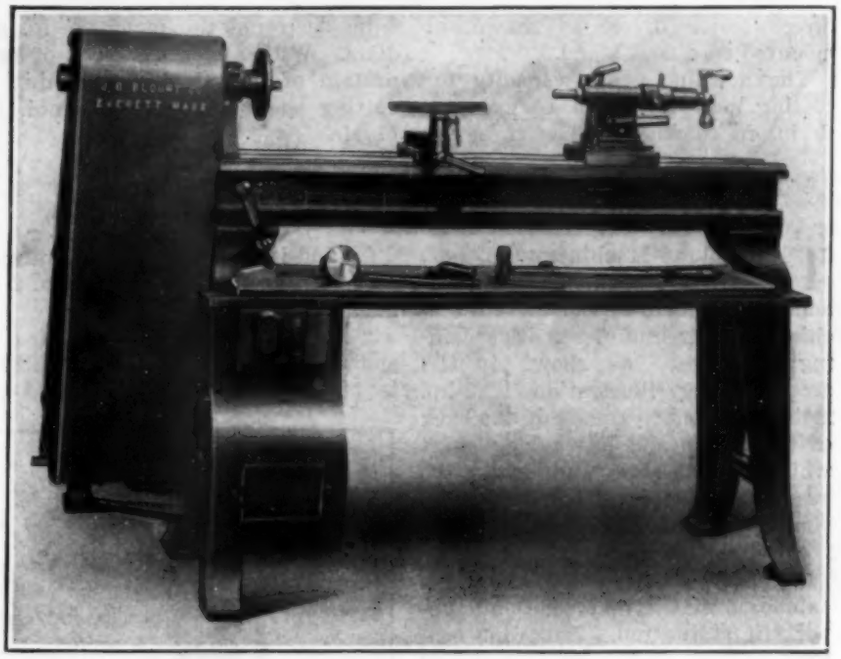
The device is fitted at the filling point of the tank. It consists of a



"Ventex"

cylindrical metal mesh screen, double walled, to permit the free passage of liquid, vapor or gas, but it will not allow the passage of a spark or flame. A safety pressure valve cap closes the opening of this screen tube, so as to make the container gas tight. It is only necessary to remove the cap when filling. In addition to the safety pressure valve, there is an automatically operating intake valve to relieve the vacuum when the tank is being emptied. These valves are controlled by weights or springs according to conditions. The size of the double screen cylinder is also in proportion to the tank's capacity.

It is claimed that with this device, if a tank containing inflammable liquid is subjected to high heat, an explosion will not occur, although the escaping vapor may readily burn as it issues from the release valve.



Blount Improved Motor-Driven Speed Lathe

Blount Improved Motor-Driven Speed Lathe

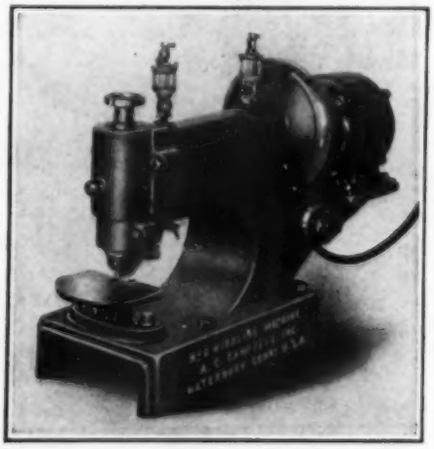
The J. G. Blount Co., Everett, Mass., has recently redesigned and improved its motor-driven speed lathe to furnish greater ease of operation and maximum safety to the operator. This lathe is belt driven from a motor mounted on an adjustable motor plate within a fully-inclosed cabinet-type headstock leg. To provide additional safety, a steel guard fully incloses the headstock end of the lathe.

Speed variation has been simplified by the addition of a belt shifting device operated by a single hand lever. This method is not dependent upon the loosening of the belt tension, hence it is claimed that wear, tear and slip of the belt are eliminated.

The headstock has been redesigned and the lathe can now be furnished with a spindle running in either ring-oiling bronze bearings or heavy-duty deep-groove ball bearings. In other respects the design of the lathe remains the same, so that all extra attachments such as slide rests, compound rests, cut-off rests, set-over tailstock and turrets can be fitted as on other Blount lathes.

Campbell No. 0 Nibbling Machine

The No. 0 bench-type nibbling machine has been added to the line of similar machines made by Andrew C. Campbell, Inc., Bridgeport, Conn. The machine can be furnished with



Campbell No. 0 Nibbling Machine

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direct motor drive, as shown, or mounted on a floor stand.

The machine has a capacity for cutting material up to 14 gage, or ⅜ in. in thickness. The throat is 8 in. deep and the punch ⅞ in. in diam. With a normal speed of operation of 950 strokes per min., a cutting speed of 5 ft. per min. is obtained.

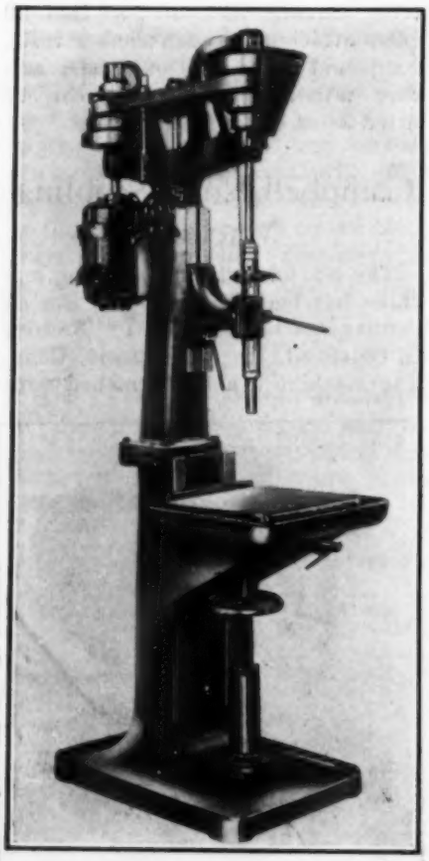
Edlund Sensitive Drilling Machines

THE Edlund Machinery Co., Inc., Cortland, N. Y., has recently added a built-in motor-driven machine to their line of sensitive drilling machines. As shown in the accompanying illustration a 1-hp. motor is bolted to a plate on the back of the frame and has a long shaft which extends into and drives the rear cone which is mounted in a similar position, but reversed, to the front spindle cone.

An arm of the one piece frame extends over the rear cone and supports it at the top. With this construction all belt pull is removed from the motor shaft.

The machine can be furnished with or without power feed and either with one spindle or in gangs up to six spindles. It has a capacity of ¾ in. and is of the same general construction as this company's No. 2-B machine.

The open-type No. 2-B machine is shown in Fig. 2. It has a built-in tapping spindle and is mounted on ball bearings throughout. Any number of spindles, from one to six, can be supplied. Sixteen ball bearings are used for each spindle.



Edlund Sensitive Drilling Machine with Built-in Motor Drive

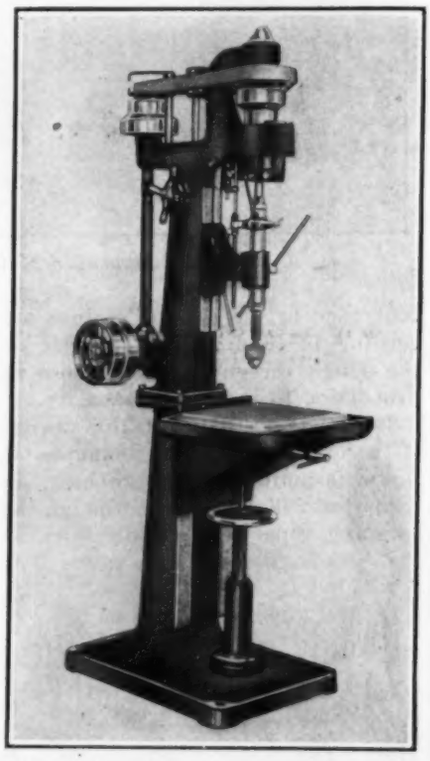


Fig. 2—Edlund No. 2-B Sensitive Drilling Machine with Buit-In Tapper

The drive for the forward rotation of the spindle is taken from a hardened-steel, female cone clutch which is attached to the front cone pulley. The forward clutch drives a double-faced, bronze, male cone clutch which is splined to the spindle. The forward clutch also contains a gear which drives the reverse clutch through a compound gear and idler. When the spindle has advanced the proper distance the male clutch is released from the forward position and forced into engagement with the reverse clutch. This construction is said to readily lend itself to the use of multiple heads for tapping as the entire spindle reverses.

The tapping spindle may also be used for drilling. Three tapping speeds are provided and a 2-in. spindle drive belt is furnished. The machine will drive effectively a ½-in. tap of 13 threads.

In all machines the maximum distance of the spindle nose to the table is 32½ in. In the multiple-spindle machines the distance between spindle centers is 9½ in. A No. 2 Morse taper is furnished in all cases. The vertical traverse of the spindle is 6½ in., that of the arm, 9½ in., and that of the table, 16½ in. The spindle is 8 in. from the column face. The single-spindle machine has a table surface of 14⅝x16 in., while the table of the six-spindle machine has a surface of 16x63½ inches.

The single-spindle machine weighs 912 lb. net, while the six-spindle machine weighs 3,430 lb. net.

Morrison Speed Reduction Units

The Morrison Machine Co., Paterson, N. J., is marketing a line of speed reduction units of improved design for general use. The entire gear unit is mounted in a split frame so that the input shaft can be placed in any position within its range to accommodate itself to the base-to-center height of the motor to which it is coupled. In the unit shown this base-to-center height can be varied from 5 to 13 inches.

As shown in the cross-sectional view, Fig. 2, the gear shafts are all mounted on ball bearings. Both

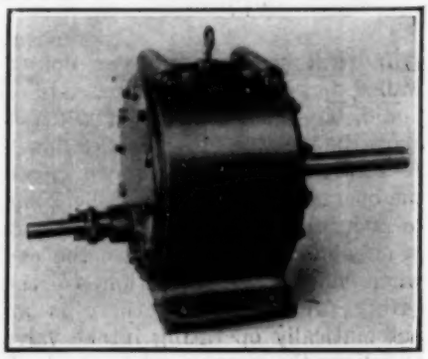


Fig. 1—Morrison Speed Reduction Unit

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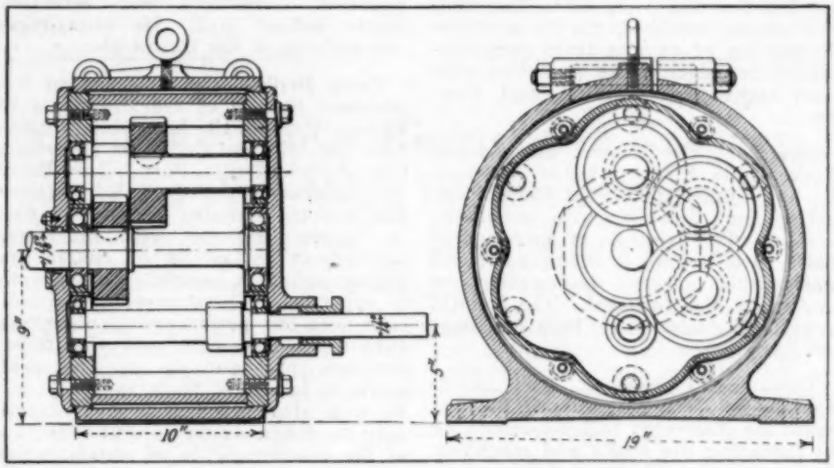


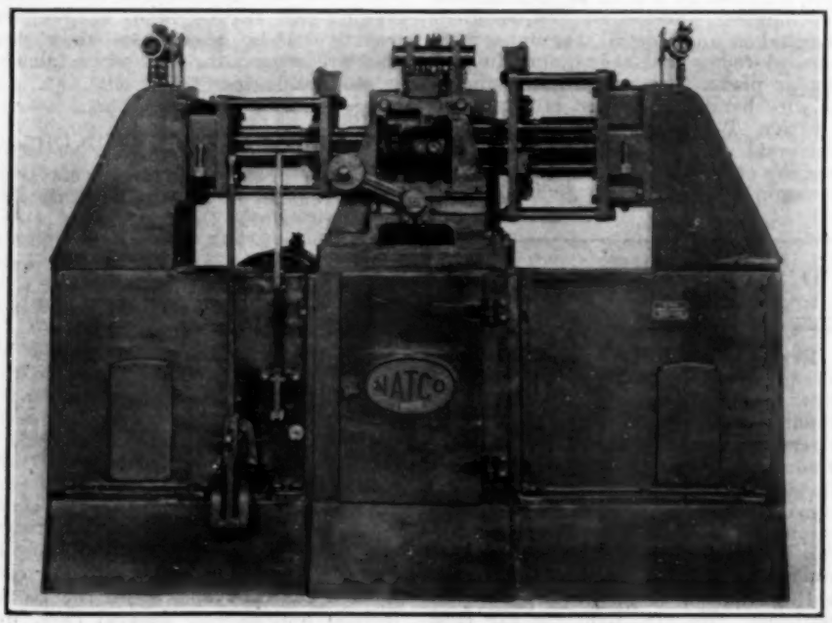
Fig. 2—Cross-sectional view of a 20-to-1 reduction unit

gears and bearings are lubricated by oil which fills the lower part of the case. A stuffing box prevents leakage when the input shaft is in a low position. Six drain plugs are provided so that the casing may be drained in whatever position it happens to be. The gears are all made of cut steel of ample proportions.

The unit pictured is rated to transmit 5 hp. with a reduction of 20 to 1 in four steps. By slight modifications it is possible to get almost any desired range of reduction in six steps by placing the countershafts at the points of the hexagon.

Natco Lead-Screw Tapper

THE Natco tapper, made by the National Automatic Tool Co., Richmond, Ind., has a patented lead-screw feed to each individual spindle. Each spindle has its own feeding mechanism so that holes of different sizes and leads may be tapped at the same time. A thread on the shank of the spindle has the same leads per revolution as the tap it drives. This spindle revolves in a stationary bronze nut and at each revolution the tap goes forward at the correct lead. In this way it is said that a perfect thread is tapped in every hole and the life of the tap is lengthened.



Natco Lead-Screw Tapper

The entire feed mechanism is carried on a heavy plate bolted to the front of the head. The bronze driving nuts are held in this plate by split springs on the front side and flanges on the back side. These flanges each have four grooves 90 deg. apart. Adjustable slides fit in these grooves and lock the nuts in place. When these slides are loosened, the nuts may be turned and the spindles set to tap any desired depth.

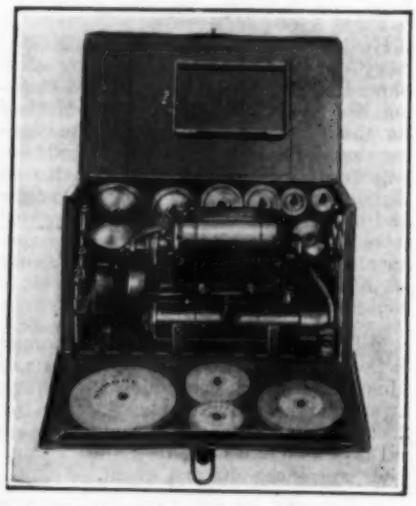
The split springs on the front serve as a safety device. Should the tap strike a broken drill or other obstruction the spring releases the driving nut and runs back on the spindle shank instead of forcing the spindle forward and breaking the tap. This safety feature is said to have practically eliminated tap breakage.

The machine shown has counter shaft drive but similar machines are also built with direct motor drive, if desired. The two levers on the front of the machine are for starting and emergency reverse. The machines are built in a wide range of sizes covering all kinds of work.

All bearings on the tappers are lubricated from tank oilers with individual connection to each bearing.

Carrying Case for Dumore Portable Grinders

The Wisconsin Electric Co., Racine, Wis., has recently designed steel carrying cases for the No. 2-AG and the No. 3 multi-speed Dumore grinders. The No. 3 machine in its



Carrying Case for Dumore Portable Grinder

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case is shown in the accompanying illustration.

These cases have been designed to make the handling of these grinders easy, so that all the equipment will be in one place where it is available. The box will stand considerable abuse, and a handle on the top makes it readily portable.

Trade Catalogs

Conveyors.—The Standard Conveyor Co., North St. Paul, Minn., has issued two descriptive circulars on its conveying equipment. One is devoted to pilers for handling sacked material, such as sugar. The other is devoted to gravity roll conveyors. Both pamphlets are well illustrated throughout by means of photographs and cross-sectional views.

Cutting Lubricant. The Sun Oil Co., Philadelphia, Pa., has published a bulletin entitled "Cutting and Grinding Facts" in which examples of the uses of Sunoco emulsifying cutting oil are described. Typical examples of lathe work, drilling, gear cutting, milling, sawing, grinding and special operations are given. In each case a photograph is used to show the operation and complete data are given as to feeds, speeds, production, and proper proportion of Sunoco cutting lubricant to the amount of water used.

Hammers. The Beaudry Co., Inc., 141 Milk St., Boston, Mass., has recently published "Illustrated Catalog No. 10," describing its belt and motor-driven forging hammers. The publication contains twelve 6x9-in. pages and is well illustrated by means of photographs. The chief features of construction of these hammers are pointed out. Brief specifications are also given.

Heat-Treating. The Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa., has recently published Catalog No. 93 entitled "The Homo Method for the Tempering of Steel." The catalog contains twenty-eight 8½x11-in. pages and is profusely illustrated throughout by means of photographs and charts. In it the results obtained from the Homo electric tempering furnace are compared with other methods of heat-treating. Exact temperature control is featured.

Milling Machines. John W. Chapman & Co., Warsaw, Ind., has issued a small illustrated leaflet describing its milling attachments for drill presses. The No. 2 plain type and the No. 2 semi-universal type machines are described. Complete specifications are given.

Oxygen Manifolds. The Air Reduction Sales Co., 342 Madison Ave., New York, N. Y., has published Catalog Section No. 6 on the Airco Davis-Bournonville oxygen manifolds for the pipe-line distribution of oxygen from centrally-located cylinders. The pamphlet contains eight pages and is well illustrated.

Riveters. The Hanna Engineering Works, 1765 Elston Avenue, Chicago, Ill., has published Bulletin R-206 illustrating and describing its pneumatic riveters. The principle of operation of this type of riveter is brought out and considerable general information on riveting is also included. The bulletin is well illustrated with both halftones and line cuts.

Threading Equipment. The Landis Machine Co., Inc., Waynesboro, Pa., has issued an illustrated bulletin describing its threading die heads and machines. Many examples are given of this equipment in actual use. The bulletin contains twelve 8½x11-in. pages and is profusely illustrated throughout by means of photographs.

Welding. The General Welding & Equipment Co., 66 Brookline Ave., Boston, Mass., has issued a leaflet describing some special oxy-illuminating gas welding equipment. Boosting units are also described and illustrated.

Wrenches. The Husky Wrench Co. Milwaukee, Wis., recently issued two publications on its line of socket wrenches and accessories. The first is a catalog of types, sizes and prices and is attractively bound in loose-leaf form between paper covers. The catalog is well illustrated throughout.

The second publication is also in loose-leaf form. It contains socket wrench data. There are twenty letter-size pages, multigraphed and illustrated by many line drawings. The treatment is entirely technical in character. The wrenches are first classified, followed by a brief history of their development. Socket wrench design is then taken up in detail, beginning with general forms and then going to particular parts, such as the development of wire handles, of speed cranks, combination T-handles, ratchets, sockets, universal joints and adaptors. A lengthy comparison between square and hexagon handles is also given.

Pamphlets Received

Reparations. The National Foreign Trade Council, 1 Hanover Square, New York, N. Y., has published Fact Finding Pamphlet No. 2 entitled "Can Germany Keep Up Her Payments?" by Henry M. Robinson, a member of the Dawes Commission. The bulletin contains sixteen 6x9-in. pages. Mr. Robinson is of the opinion that Germany can pay and at the same time prosper, since only about 5 per cent of its present income must be devoted to such purposes. He also indicates the reparation burden is less than that used to maintain Germany's war establishments before 1914. He discourages any revision of the Dawes plan.

Twist Drills. The Engineering Experiment Station of the University of Illinois, Urbana, Ill., has published Bulletin No. 159 entitled "An Investigation of Twist Drills, Part II," by Bruce W. Benedict and Albert E. Hershey. The bulletin contains seventy-six 6x9-in. pages and is well illustrated throughout by means of charts and photographs. A complete bibliography is appended. These experiments indicate that the power consumption, the torque on the drill, and the thrust decrease progressively as the helix angle is increased from 15 to 45 deg. It was also found that drill torque may be taken as an accurate measure of the machineability of metals, which effect depends upon the hardness and plasticity and cannot be correctly measured by the Brinell number. The bulletin may be obtained from the University at a price of 40 cents.

Plan Standardization of Screw Threads in Canada

At a recent conference in Toronto, Canada, at which a number of manufacturers of machine screws and machine tools were represented, it was agreed that the machine screw situation in Canada could be greatly improved by a reduction in the number of varieties of threads. The meeting, which was held under the auspices of the Canadian Engineering Standards Association, also decided that the carrying on of a campaign of education among customers would tend to reduce the variety of orders received. A subcommittee was appointed to investigate the matter further and to prepare tentative data sheets to show the standard screw threads which should be stocked.

January Auto Production

January production (factory sales) of motor vehicles in the United States, as reported to the Department of Commerce, was 234,130, of which 196,973 were passenger cars and 37,157 were trucks, as compared with 165,822 passenger cars and trucks in December, and 302,741 in January, 1926.

The report is based on figures received from 161 manufacturers in the United States, 54 making passenger cars and 125 making trucks (18 making both passenger cars and trucks). Data for earlier months include 91 additional manufacturers now out of business, while January data for 21 small firms, mostly truck manufacturers, were not received in time for inclusion in this report. Figures for passenger cars include taxicabs and those for trucks include ambulances, funeral cars, fire apparatus, street sweepers and busses.

NEWS OF THE WEEK

Germany Shows Remarkable Recovery from Post-War Industrial Slump

British coal strike furnished the inspiration

By Our Berlin Correspondent

THE year 1926 at its beginning had been labelled a black year. Most gloomy views prevailed as to what it held in store for German industry and for business in general. It quite justified this bad reputation in its earlier months, but thereafter the course of events took a rather sudden turn for the better. The improvement which has taken place is generally ascribed to the British coal strike, which roused the German coal and steel industry to activity. But people watching keenly the various business barometers which individually and jointly serve as the basis of conjecture in economic problems, thought they could perceive signs of a turning of the tide at an earlier stage. In fact, in February, 1926, the process of elimination of the unfit, which the mark stabilization has brought about, had come to a standstill after involving a great number of firms. The same applies to the movement of the rate of employment. On the strength of those facts and a number of others it was believed that the lowest depth of depression was reached in the early months of 1926. The improvement was, however, hardly perceptible and it is quite sure that, had the British coal strike not come, the up-hill climb would have been very slow and tedious.

Optimism Prevailing Mood

The year 1926 has given rise to glowing optimism among leaders of German finance and industry, and this is perhaps the most valuable gain it brought, as it inaugurated a new spirit of enterprise, so long absent in Germany's business life. How far this optimism is justified and whether it is not premature is a matter of opinion. The German stock exchanges are apparently entertaining a most sanguine view of the situation, expressed by a rise in the value of stock, such as in normal times has never been heard of. A number of shares doubled and trebled their value and the total of stocks quoted at the German exchanges, representing about 7 billion marks of capital, has risen in the average by more than 50 per cent, which means several billion marks increment to Germany's national wealth. On the other hand the lower levels of commerce and industry have hardly yet noticed a betterment, which seems to indicate that the improvement is still confined to the main arteries.

The past year has brought some material and indisputable gains. It can safely be said that it has been the best one in Germany's post-war history. The state treasury has increased its gold reserves by 600 million marks; the deposits of the saving banks have risen from 1.7 billion marks to nearly 3 billion marks; the fiscal revenue has increased from 430 million marks to over 600 millions per month; bankruptcies, which in January, 1926, had run up to over 2,000, have gradually dropped to 435 in December; and unemployment from 20 per cent in January to 14 per cent in December, 1926. The number of short time workers which amounted to 18 per cent of the total at the beginning of 1926, was only 8 per cent at the end of it. There were still 1,360,000 unemployed left in December, 1926, which is far above the normal but nearly 400,000 workmen have left the ranks of the unemployed in the course of the year.

The most satisfactory development and one that clearly indicates the progress made is the return of foreign trade. In the year 1925, the import exceeded the export by about 3½ billion gold marks. In 1926 the two sides of the ledger nearly balanced. The following figures show the development of foreign trade in the last three years (the records of previous years are valueless on account of the currency fluctuations).

	Import	Export Million Gold Marks	Import Surplus
1911	9,706	8,106	1,600
1913	10,770	10,097	673
1924	9,109	6,548	2,561
1925	12,428	8,798	3,630
1926	9,951	9,818	133

It is seen from these figures that the export rose by more than one billion whereas the import dropped by 2½ billions.

What part raw material, semi-finished and finished products took in the import and export may be seen from the following figures.

	Import		Export	
	Raw material and semi-finished goods	Finished products	Raw material and semi-finished goods	Finished products
1911	5,419	1,298	2,068	5,220
1913	6,242	1,479	2,658	6,396
1924	4,584	1,781	907	5,191
1925	6,211	2,005	1,640	6,626
1926	4,924	1,323	2,363	6,968

Comparison with 1913 shows that the total export of that year was not quite reached in 1926, while that of finished products has been left behind. The increase in the export, as against 1925, was due chiefly to the share of four groups of merchandise, foremost of which was fuel, which owing to the British strike naturally enjoyed a very brisk business. The others were iron and steel products, machinery and chemical products.

Export of	1925 Mill. M.	1926 Mill. M.
Coal and other mineral products	574	1,078
Iron, steel and goods made thereof	1,230	1,460
Machinery	656	717
Chemical products	898	994
	3,358	4,249

There is no doubt that part of the gains made in the foreign business of 1926 are of a transitory nature only.

Adjustments Expected

The fuel export will drop again and imports in general will naturally rise in a measure as industrial activity grows and capital flows into the country. But the foreign trade of 1926 has poured fresh life blood into the country, greatly contributing to its recuperative powers. Perhaps the best indication of growing strength is the fact that confidence is again returning to the population and to industry, which had been severely shattered during past years, when the Germans were almost inclined to believe that their industry had fallen behind times as regards quality as well as economical production. However as soon as manufacturers recognized their shortcomings (they were the last to do so, it was being said) a decided improvement has commenced, which promises a brighter future.

Exports a Stimulant

There is still a long way to go in this respect and, although the gains made so far must not be underrated, they should not be overrated. German business and businessmen are not yet what they were in 1913, as regards enterprise, initiative, conception of possibilities, quick grasp of opportunities and above all clear discernment of waste in any shape. Part elimination of competition through over-organization of industry has produced unhealthy conditions by which manufacturers suffer quite as much on one side as they profit on the other. Were it not for the fact that German industry is dependent on export and has to measure its strength with that of other countries, were it left to itself, it probably would never have recovered from the slump of the past. The competition provided in this way has stimulated activity and careful study of details.

Chicago A. S. M. E. Plans Meeting on Machine Shop Practice

For the past few years, the Chicago section of the American Society of Mechanical Engineers has considered its spring machine shop practice meeting one of the major events of the seasonal program. This year, a program of exceptional interest has been prepared, including four papers, and two industrial motion pictures, that will be presented during the afternoon and the evening of March 16. The Machinery Club in Chicago has been selected as the meeting place.

In addition to the regular A.S.M.E. membership, invitations have been sent to the members of the Machinery Club, the mechanical division of the Rotary Club, the Western Society of Engineers, and the National Pressed Metal Society, so that with five societies participating, a record-breaking attendance is anticipated.

The afternoon session will open with a motion picture showing methods used in the manufacture of watches at the Elgin National Watch Co. Some of the operations covered in the film are the main processes of manufacture, automatic machining operations, assembly methods, how time is taken from the stars, and the use of watches in connection with railroad operation. In a paper on, "Changing Manufacturing Methods to Reduce Costs," A. Langsner, chief engineer, the Eugene Dietzgen Co., will illustrate how large savings are made possible by incorporating cost-cutting devices in the manufacture of mechanical products. Several examples of redesigned units will be on exhibit to point out the possibilities in this field. The second paper, "Stelliting of Metal Parts Subjected to Wear," by E. F. Smith, the Haynes Stellite Co., will outline the use of stellite as applied to resistant-wearing surfaces, and the method of surfacing the metal to such parts. Examples of stellite-surfaced work will be exhibited.

Following these papers, the meeting will adjourn at which time the facilities of the Machinery Club will be available for the entertainment of visitors. A dinner will be served in the evening. Following the dinner, a motion picture "From Mine to Consumer," by the American Brass Co., will be shown. Procedures utilized in the mining of brass and copper, rolling-mill operation, the working of brass, extrusion methods, and laboratory control, will be illustrated.

A feature of the meeting will be the presentation of a paper by Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association, on "The Engineers' Contribution to the Growth of Machinery." In his talk, pointing out the machine's contribution to wealth and welfare, Mr. DuBrul will emphasize the importance of using skill and intelligence in the operation of machinery to which power is applied. Mr. DuBrul will also point out that the use of power and the division of labor are purely incidental to the more fundamental things that make the application of power possible.

"Automatic Feeding Devices for Machine Tools," is the final topic on the program. This subject will be discussed by W. W. Nichols who will show the possibilities of handling parts automatically, the factors governing the use of automatic devices, and practical applications of methods applied to various types of machines.

An open invitation is extended to all men in the territory interested in modern manufacturing methods to attend and to take part in the discussions. Membership in the participating societies is not essential.

U. S. Is Greatest Factor in Latin-American Trade

United States imports from all of Latin America in 1926 (with the exception of a few islands in the West Indies for which figures are not yet available) increased by 3½ per cent over 1925, reaching a value of $1,044,884,000 as compared with $1,009,188,000 in 1925. On the basis of 1925 figures it is conservatively estimated that our imports from the islands of the West Indies not taken into consideration in the above figures amounted to approximately $30,000,000. Exports from the United States to Latin America, on the other hand, declined by more than 1 per cent, falling from a value of $882,320,000 in 1925 to $872,800,000 during the past year. These figures are from a recent report of the Department of Commerce.

From the above it is apparent that in 1926 we bought from Latin American countries approximately $200,000,000 more goods than we sold them. It must be remembered, however, that a large proportion of our imports from Latin America consists of petroleum, sugar, bananas, copper, silver, and other commodities, shipped to the United States by American producing companies established in Cuba, Mexico, and certain South and Central American countries. The value of such commodities cannot be regarded as a complete debit, since out of the proceeds of the sales are derived not only the dividends paid to the American shareholders of such enterprises but also the overhead expenses of the organizations maintained in the United States, selling expenses in the United States and surplus earnings carried as reserves in the United States.

On our large investments in Latin American government obligations as well as in petroleum, sugar, banana, mining, and manufacturing enterprises in Latin American countries, large sums must be received each year to cover interest and dividends. These payments are paid largely in goods although they may be covered out of new loans.

Other sources of invisible income from Latin America which operate as offsets to this "unfavorable" trade balance, are ocean freight charges paid by the Latin American purchasers of goods imported in American bottoms, banking, insurance, and other similar commissions.

With the single exception of 1918 which, because of inflated war-time prices, was the peak year in Latin American trade values, exports to the United States in 1926 from the Latin American republics were the largest of any single year and if measured in volume or quantities their shipments to us during this period were the largest in their history.

The steadily growing proportion of Latin American products exported to this country is indicated by the fact that last year we took 39 per cent of all their export shipments as compared with 30 per cent in 1901. The stimulating effect which the Panama Canal has exerted on the trade of the republics of the West coast of South America with the United States is shown by the fact that the ratio of their exports which come to us has risen from 8 per cent of their total sales abroad in 1901 to 35 per cent in 1926. In the case of the more northerly republics—Mexico, the West Indies and Central America—no less than 69 per cent of their entire export shipments are destined for this country.

The United States increased its purchases from the South American mainland last year by $50,000,000 or 9½ per cent as compared with 1925. This was the largest relative increase of any continent in our import trade. The total value of our imports from South American countries last year amounted to $568,000,000 as against $518,000,000 in 1925.

Executives Hear About Cutting Efficiency of Gas Units

Over one hundred officials of gas companies and industrial representatives attended a meeting and demonstrations of oxy-city gas cutting and intensive heating in the shops of the General Welding and Equipment Co., of Boston, Mass., on Feb. 18. This meeting was held at the invitation of E. G. deCoriolis, of the Combustion Utilities Corporation and consulting engineer of the Boston Consolidated Gas Co.

Dr. A. Krebs pointed out that city gas and similar gases of lower heat units can be used for cutting and intense heating as well as acetylene, provided that torches are so constructed that they issue flames of high heat concentration and of a gas density and mixture which creates the most instantaneous combustion.

Mr. de Coriolis addressed the assembly, giving his ideas and experiences with this new development from the standpoint of the gas companies. He also pointed out that the use of pressure city gas brings the cost of combustible gas down to about one-sixth of the cost of acetylene. The invisible expenses and bother connected with handling tanked gases are eliminated through this automatic and ever ready supply of pressure city gas. This convenience of having gas always on tap coupled with the materially lower gas cost makes this new development worthy of consideration by gas companies and consumers.

William Irby, chemist of the General Electric Co., described the experience he had had and the savings which were produced with the city gas cutting installation in the steel foundry of the General Electric Co. at Everett, Mass. Then followed a cutting demonstration on risers by Mr. Keough, chief operator of the General Electric Co. at Everett.

Mr. Guptill, of the General Welding and Equipment Co., cut all kinds of shapes with an automatic cutting machine.

Second Conference on Heating at Purdue

The engineering extension department of Purdue University announces the dates of March 23, 24 and 25, for the second annual conference on industrial electric heating which will be held at Lafayette, Ind., under the direction of the school of electrical engineering with the electric utilities and the manufacturers of electric heating equipment, co-operating. Last year's conference held at Purdue University, was the first of its kind and was attended by a large group of manufacturers interested in the latest developments of electric industrial heating.

The conference this year will include the discussion of developments in electric industrial heating, its application to low medium and high temperature work. Equipment in these fields and demonstrations will feature the conference.

Authorities on electric industrial heating will be present and take part in the meeting. Manufacturers interested in the latest developments in the use of electricity in their manufacturing processes will have an opportunity to get the latest information on this subject.

Exports of Farm Machinery Set New Record

A new record was established in exports of agricultural implements from the United States during 1926, when the total value of those exports reached $85,666,570, according to the Department of Commerce. Implements exported in 1925 amounted to $77,565,153.

The 1926 figure has not been equalled in any previous year and is considerably more than double the average of implements exported annually during the years immediately preceding the war. It was, however, exceeded by the exports for the 12 months ended June, 1926. The only other calendar year in which exports exceeded $80,000,000 was 1920, when they amounted to $81,422,090. That, however, was a year of abnormal demand and high prices, whereas the present figure is the result of a consistent and rapid increase since 1922.

The largest item exported during 1926 was wheel tractors, of which 49,984 valued at $28,281,602 were exported. This is an increase of approximately 5,000 tractors and $2,000,000 over the exports in 1925. Shipments of tractors varied considerably throughout the year, averaging approximately $3,000,000 during each of the first six months, but showing a considerable decrease from this figure during the last six months. During the first half of the year they were considerably higher than the 1925 shipments in each month, but in the second half, with the exception of the month of September, 1926, shipments were less than those in 1925. Shipments of tractors and parts in 1926, however, exceeded those for any other year.

Obsolete vs. Modern Equipment

William Feather, in a bit of business philosophy says: "The industrial success of America rests on our willingness to throw out the old and inefficient and install the new and efficient. High wages have compelled us to adopt this policy, because the only chance the American manufacturer has for survival in the world market is by employing machines to do his work. In this situation the business man who would like to play safe finds himself left on base. Alert competitors, awake to the possibilities for improvements, surge forward, and the mossback dies."

France Appropriates More for Planes

Appropriations in the 1927 budget, already adopted by the French Chamber of Deputies, provide for subsidies to French aviation companies to the amount of 78,650,000 francs, as compared with 60,500,000 francs in 1926.

The debates indicated that the economy realized by suppression of the Undersecretariat for Aviation in France has been followed by serious disorganization of French aviation at the moment when both internal and external conditions demand strong direction.

Furthermore, if foreign equipment coming into use on French lines, should place French companies in a position of inferiority in exploiting certain lines, not only would these companies and the State lose their prestige and their money but the whole French aeronautic industry would suffer, it was asserted.

With respect to the aeronautic industry, a policy of prudent support during the conditions through which it is passing is favored. Owing to the closing of certain foreign markets, as well as the restriction of credits, many firms are already in trouble and some undoubtedly will go out of existence, according to reports. It was pointed out, therefore, that official services should aid by their support and orders those firms which represent a technical and industrial effort of importance. Recommendations were made that the policy of commercial aviation should be completely revised.

State Subsidy for Machinery Builders in Japan

Acting under instructions from the Japanese government, specially appointed committees in Tokyo, Osaka and Nagoya have been investigating the problem of extending the development of the domestic machinery industry, state advices to the Department of Commerce. These committees have been studying the subject, and plans have now been formulated as regards precision machinery, power machinery, spinning machinery and machine tools and equipment.

The Japanese Department of Commerce and Industry is to make arrangements for instructing workmen in the use of precision machines in those government and private mills where a high degree of efficiency is maintained. Plants with superior efficiency are designated for this work in order that the government may take measures to maintain their production capacity, and assist in effecting improvements in manufacturing methods. The government is to be asked to use its influence in establishing guilds, and other associations composed of manufactures of precision machinery.

Along the lines of power-generating machinery, the plans state that the production of the following call for especial encouragement at this time: water tube steam boilers, steam turbines, gasoline engines, diesel engines, and water wheels. Well-equipped manufacturers are to be given subsidies for the production of spinning machinery and experimental work, according to the contemplations of the plans. The co-operation of manufacturers and spinning companies is to be encouraged with a view to unifying the types of machinery employed and to encourage the use of domestic machines.

Stefansson Will Address Export Managers

The annual get-together meeting of the Export Managers Club of New York will be held in the Hotel Pennsylvania, New York, on March 22. The general theme of the meeting will be sales, and several addresses have been included in a varied program that will deal primarily with that subject.

"The Export Manager as a Sales Builder," is the title of the opening address by A. Schoonmaker, of the Bourne-Fuller Co. "Sales Research in Planning Selling Abroad," is the subject assigned to V. E. Parmenter, of the Dennison Manufacturing Co. C. C. Martin, of the National Paper and Type Co., will discuss "Credit to Foreign Buyers as a Sales Asset."

The annual banquet will be held in the evening. W. R. Cummings, president of the club will be the toastmaster, and addresses will be made by Vilhjalmur Stefansson, arctic explorer, and by P. B. Deane, sales manager of the York Safe and Lock Co.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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THAT the stock market is getting into altitudes where its perch is somewhat precarious is indicated by its action last Monday. Upon the announcement that in the Los Angeles Salt Lake R.R. case the Supreme Court had upheld the authority of the Interstate Commerce Commission to make valuations of the roads for rate making purposes, the prices of some of the overbulled rail stocks dropped suddenly by 8 to 10 per cent or more. The importance of the decision was at first exaggerated, for the roads may still seek court protection against use of valuation "for some improper purpose"—including, it is to be presumed, confiscatory rate-making. After it was understood that the test case had turned out to be no test of rate making at all most of the declines recorded were recovered. But the incident shows how susceptible speculation would be to any real change in conditions or sentiment.

Another influence that has been slightly disturbing is a report of the Federal Trade Commission submitted to the Senate in pursuance of the Norris resolution passed two years ago. The report suggests the advisability of enacting legislation that would prevent the pyramiding of public utility corporations by consolidation and otherwise, and those who sponsored the investigation are likely to introduce bills embodying its recommendations. In some quarters it is taken to mean that the integration of hydro-electric power plants is at an end, at least for the present, and that there will be an early cessation of the flow of new securites that has been created.

But these are about the only affirmatively adverse developments, and the easy money markets supplied such abundant support to stocks that after the Monday scare was dissipated a number of important issues, including United States Steel, made new high records for all time. The statement of the Federal Reserve Banks on Thursday reported the highest reserve ratio in nearly three years, 80.1 per cent compared with 74 a year ago. Some see in such large credit reserves only a reflection of dull business, but fortunately most men soon forget the past and it is equally true that low money rates are often harbingers of expanding activity to come.

For the rest business has been about as usual and the influences that need to be considered are not in any sense novel. Car loadings for the week ended Feb. 12 showed an increase of 50,692 cars over last year, but of this increase 46,868 were coal cars, so that no important gain in the turnover of commodities other than coal is indicated. About April 1 coal loading will decline, whether the threatened strike is then called or not. A suspension now appears to be unavoidable, but it may be limited to the central field. Consumers view the prospect with equanimity and prices are actually sagging.

WHAT'S DOING IN INDUSTRY

THE STATEMENT of the Federal Reserve Banks shows the highest reserve ratio in nearly three years. Some see in such large credit reserves only a reflection of dull business, but fortunately most men soon forget the past and it is equally true that low money rates are harbingers of expanding activity to come.

NEW YORK finds the prospects higher than at any time this year so far as machinery is concerned. In New England the report is that business is in good condition. The prospects are at least equal to those of a year ago and the business on the books is actually larger. Railroad buying has been of considerable help. Little railroad buying is reported in Philadelphia, however, and the orders from automotive plants are spotty and for single tools.

CINCINNATI reports an upward trend with sales coming somewhat easier than previously and inquiries increasing. There is little change in Detroit, where the inquiries are numerous but the sales continue spotty. The outlook is good in Chicago but at the present things are rather quiet. A conservative attitude on the part of buyers is considered in Milwaukee as retarding the progress that should be expected but an improvement in conditions is looked for in March. Sales in Buffalo have so far been dull but the increase in the number of inquiries and the amount of business now at hand is taken as a good sign for the future.

In the industries moderate seasonal improvement seems to be the rule. Increased buying and production are reported from both the iron and steel and the automobile centers. The gains in steel have been obtained at the expense of price but enough business has been booked to make it likely that average quotations, which are the lowest since 1922, have struck bottom. January production of 234,130 automobiles was low as compared with 302,741 a year ago, and the February figure may fall as far short of the 375,000 produced in 1926. Even so an output of 300,000 monthly, with additional increases likely later, is an astonishingly rapid recovery from a slump that carried production as recently as December to the lowest levels in five years, and the unemployment that has been so much complained of in the Middle West will probably soon be relieved.

The problem of installment buying and the volume of installment obligations outstanding continue to be widely discussed. Those in the know say that one or more other cases of "embarrassment" may follow the troubles of the Philadelphia firm that were recently aired, but the technique of resuscitation is so well developed that fatalities will be few. The effect will be salutary in that it will limit excesses, and the credits ganted to installment buyers may be reduced somewhat in volume. But the business has been more soundly conducted in the automobile business than in some other fields, and the motor manufacturers will be slow to feel the effect of credit restriction.

While the remarkable spectacle of the Boulder Dam filibuster has filled the eye of Washington observers more important decisions were in formation in the White House where the McFadden bill awaited the President's signatured or veto. He has just signed the McFadden bill. Its main provisions have been so well advertised that they need no further repetition, but at least one of its less-discussed sections has a broad bearing on business that should not be overlooked. For it permits national banks to lend on improved real estate for five years instead of one and thus makes available a vast new credit reservoir for mortgage borrowers.

The cotton market is also active and reports from both raw wool and woolen fabrics are reasonably favorable. Silk has advanced sharply, and rayon, which is an excellent barometer of textile conditions, also has been marked up.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

PHILADELPHIA

Business among machinery and machine tool producers has been on a fairly satisfactory level during the last two weeks, with general industrial establishments in the East placing some fairly sizable orders for tools. One of the smaller producers reported that a canvass of the territory contiguous to Philadelphia revealed several good lists in the process of preparation, and some orders have been placed. The lists were being made up by general industrial concerns.

There has been a falling off of buying among automobile manufacturers who frequently enter the Philadelphia market. Inquiries do not indicate any early return to quantity buying, although there are spasmodic single tool purchases.

Some inquiries have been made for vertical borers and millers, and two or three orders have been placed. There have been no purchases of note in this market from any of the railroads during the last two weeks.

NEW YORK

The best that can be said about the present condition of the machinery and machine tool market in this territory is that the prospects for substantial business are brighter now than at any time this year. January and February brought a volume of business that was satisfactory in many ways, although there were one or two temporary slumps in buying.

Orders that have been held up pending official sanction are beginning to break, and new inquiries, asking for quick delivery give promise that March will see the closing of some good business in this market.

A feature of present business is the number of orders from small manufacturers who are finding additional use for modern tools. The greater part of the current volume of sales is to this class. A better tone is observed in the export market, some activity being reported from South American sources.

DETROIT

No material change has been noted during the past week in the market for machinery and machine tools in Detroit and other automotive centers of southeastern Michigan. Inquiries are rather numerous, but sales are spotty, being confined for the most part to single machines for replacement purposes. Some dealers report a fair business in toolroom equipment, but none have received any large orders.

The present situation is unique in that theoretically the automobile industry needs new machinery but is not buying in any appreciable quantity.

The General Motors plants continue to be the most active buyers of machinery. The Buick plant has recently finished its new assembly line, where some 900 men, through the use of new equipment, are assembling 1,050 cars a day. March will witness the completion of the new gray iron foundry at the Buick plant which will add a capacity of 600 tons daily to the present output of 550 tons.

The Wilson Foundry and Machine Co., of Pontiac, is buying some new equipment in preparation for the augmented production of Knight engines necessitated by the production plans of the new Falcon-Knight organization calling for a daily output of 100 cars.

The new motor plant at Dodge Brothers is being rushed to completion and will be completed in March. Machinery, much of which has been ordered, will be installed, at once.

CINCINNATI

While reports of Cincinnati machine tool manufacturers and selling agents vary to some extent in regard to the business of the past week, all agree that the market trend is upward. According to one manufacturer, the market was more even and had a much better tone. According to another, the week's business was satisfactory and he finds business to be holding up well, with plenty of inquiries and there is good reason for optimism. Taking the industry as a whole, it is thought that the market curve is ascending and that the demand will continue to increase.

Manufacturers and selling agents report that an increased number of inquiries came in during the week. These were received from all parts of the country and called for all types and sizes of tools. Quite a number of these inquiries called for several tools, but the majority of them were in anticipation of single purchases.

BUFFALO

Conditions in the machine tool field here are rather dull at the present time. There is every evidence that February, when the final figures are in, will not show the business that January did. Some small orders have been placed in both the machine tool and the electrical equipment field but nothing of importance is reported.

In some quarters inquiries are reported to be showing a slight increase with the passing of the month and this is looked upon as a good sign. The belief seems to be general that the year will still bring a volume of profitable business as great or better than 1926. The demand for contractors' equipment is dull but this is considered seasonable.

MILWAUKEE

Business in metal working equipment continues to be limited by the conservative attitude of nearly all users of tools. The situation, however, is considered as improving, and the beginning of March was accompanied by more favorable signs of a revival than were perceived at the opening of February. The automobile industry has not hit its usual stride as yet, but its position may be described as improving, and inquiry from this class is increasing.

The total volume of business, while it is made up of orders for one or two items, is of fair proportions and sufficient to enable makers to maintain production at a moderate average. Usually the purchaser wants immediate delivery and this is not always possible, even when standard types are specified. The bulk of the business, however, calls for special fixtures and attachments which must be made to individual specifications.

Used equipment is moving fairly well so far as the lighter types are concerned. Heavy-duty tools are in slow demand. Stocks are reported to be in fair balance and the problem of disposition is not wholly unfavorable.

CLEVELAND

Manufacturers of and dealers in machine tools report a slowing down of buying for the past two weeks. Orders closed were for single pieces from a variety of concerns. Inquiries, however, are holding up and more improvement is looked for during March. The month of February was a disappointment for the local industry. Most concerns report a decrease in the sales volume. The absence of buying by automobile manufacturers is blamed for the poor showing. With spring close at hand this industry is expected to increase its production schedules.

Road-building machinery and contractors' equipment lines are active, due to the preparations for the public improvement projects to be started soon. The used machinery market is quiet. The class of tools available are of a poor grade.

NEW ENGLAND

Inquiry business coming into the New England section in the past week did not contain any indication of a lessening of prospective business and none of the manufacturers interviewed said they had any reason for change of sentiment in regard to the outlook for the first half of the year at least. With two months practically passed the production records show business equal to that obtained a year ago and the business on the books is even slightly larger. Heavy production machinery builders report a satisfactory amount of business on hand and in prospect. Small tool makers also report satisfactory conditions. Manufacturers of carpenter tools and hardware, however, report that conditions in that industry suggest a slight curtailment.

The best buying recently came from the railroads and embraced a large assortment of shop machinery. There has also been a fair amount of business emanating from the automotive trade.

CHICAGO

Comparative inactivity has prevailed in the machine tool market for the last several days. Dealers in used tools are doing just about enough business to keep fairly occupied. Traveling salesmen, however, covering the Mid-Western states are sending in orders that in some degree offset local conditions, their reports indicating that, while general industry is not showing the production hoped for with the approach of spring, the outlook is for a better output within a few weeks.

Railroads are confining their buying to single tools and small lots, as has been the case for two or three months past. The C. & E. I. is the only road that has come into the market for machine tool equipment of any considerable importance. A new list from the Illinois Steel Co. is talked of as a near probability, but nothing definite as to when it will be sent out has developed. The International Harvester Co. has purchased a few tools recently, and is expected to buy more at an early date.

American Recommendations to Tariff Conference

The viewpoint of American business interests concerning the whole question of trade barriers was presented to a meeting of the trade barriers committee of the Internationl Chamber of Commerce, at Paris on Feb. 23, in the form of a report from the American section. Lucius Eastman, president of the Merchants' Association of New York, represented the American section at the meeting.

The views expressed in the report, together with the conclusions of the other forty-two nations connected with the international chamber will form the basis for a general report, expressing the composite opinion of world business interests, to be submitted to the economic conference of the League of Nations at Geneva on May 4. The International Chamber will be represented at the Geneva conference.

The American report was prepared by a committee of American business executives who have given a great deal of consideration to the subject of trade barriers. The report carefully points out that "the immediate trade barriers problems would seem to center on an adjustment of the dislocated economic machinery of Europe, before touching the relations of that area to other areas. The economic restoration of Europe is of first importance, not only to Europe but to the rest of the world. It therefore seems both logical and desirable, in considering the problems under review by the trade barriers committee, to distinguish those of European focus from those of wider application."

The American Committee endorses recommendations and proposals which have been suggested for the elimination of barriers to trade in Europe.

The committee explains that, "we believe we accurately reflect general business opinion in this country when we state that the United States is strongly committed to the principle that our high standards of living and wage scales require tariff protection to preserve them, so long as such great disparity exists between them and other standards of living and wage scales.

Concerning the question of governmental monopoly of raw materials, the committee declares that it is strongly opposed to any political control of exports.

Industrial Engineers at Chicago

The fourteenth national convention of the Society of Industrial Engineers will be held on May 25, 26 and 27 at the Hotel Stevens, Chicago. "The Principles of Effective Management and their Relation to Industrial Engineering" will be the main theme. Meetings will be held each morning and evening, the afternoons being devoted to the inspection of some of the most progressive plants in the Chicago district.

A feature of the convention will be an exhibition of charts, photographs, production control boards and allied devices, psychological test appliances and materials, and a special display showing what has been accomplished by some industries in simplification of their line of products. All meetings will be open to the public. Programs may be obtained from S.I.E. headquarters, 608 S. Dearborn St., Chicago.

Ruggles Nominated for Ordnance Post

The President has made the following nomination upon recommendation of the Secretary of War: Brigadier General Golden L. H. Ruggles to be reappointed as Assistant Chief of Ordnance with the rank of brigadier general.

As Assistant Chief of Ordnance, among other duties, General Ruggles has been charged with the perfection of plans for industrial mobilization so far as such plans pertain to ordnance material. His services have resulted in marked advance in the plans for the procurement of ordnance supplies in case of major emergency. Upon reappointment as Assistant Chief of Ordnance, General Ruggles would continue on this duty.

During the World War General Ruggles selected the site for, constructed, and commanded the Aberdeen Proving Ground, in Maryland.

Aeronautical Notes

Under the direction of William P. McCracken, Jr., Assistant Secretary of Commerce for Aeronautics, four aeronautic inspectors started on tours of duty in the Eastern half of the United States.

The duties of these inspectors, who are veterans' in the aeronautic service, will be to inspect aircraft for operating licenses, and to examine pilots and mechanics for licenses, when the planes or personnel are engaged in interstate commerce. They will also inspect airports in their districts and will send reports of these and other related matters to the Commerce Department.

Major Ernest L. Jones, chief of the air information division, Aeronautical Branch of the Department of Commerce, is making an official inspection trip to Lake George and to Glens Falls, N. Y., for the purpose of advising these municipalities in regard to airports. Lake George is contemplating the establishment of a combined landing field and seaplane port. Glens Falls already has facilities for landing of airplanes, but is interested in having the airport meet the requirements of the Commerce Department and to plan for any future expansion.

Aviation is increasing in popularity in Australia. The membership of the Victorian section of the Australian Aero Club is now 1,000, as compared with a membership of 50 in 1924. The de Haviland Co. intends opening a factory in Melbourne in 1927 for the manufacture of aircraft. A report from London states that Major H. de Haviland and two assistants left for Australia. They are bringing with them complete equipment for aircraft production, and operations will begin as soon as a suitable site is obtained. The first consignment of parts for assemblage will arrive in Melbourne in February. It is stated that the Australian price for Moth planes will be £825. When the factory is organized, it is hoped to use Australian parts, but, in the meantime, the parts will be imported mainly from England. This will be the first air factory to be opened in Australia. The company will concentrate on manufacturing Moths suitable for Australian conditions.

French aviation clubs and societies were active in 1926, according to answers to a questionnaire recently submitted by the Aero Club de France to its affiliated organizations. Answers were received from thirty-two clubs and societies in all parts of France and in Algeria and Morocco.

Penn Announces Changes in Engineering Staffs

Several promotions in the personnel of the motive power and mechanical departments of the Pennsylvania Railroad Co. were approved by the board of directors at its meeting on Feb. 23.

O. P. Reese, formerly superintendent of motive power, eastern Ohio division, is advanced to general superintendent of motive power, central region, with headquarters at Pittsburgh, succeeding F. W. Hankins, recently promoted to chief of motive power.

J. B. Diven, master mechanic, Philadelphia terminal division, was promoted to superintendent of motive power, eastern Ohio division, succeeding Mr. Reese. R. W. Wray, master mechanic at Renovo, Pa., was promoted to master mechanic, Philadelphia terminal division, succeeding Mr. Diven.

A. W. Byron, master mechanic at Wellsville, Ohio, was promoted to master mechanic at Renovo, and E. L. Bachman, master mechanic at Mingo Junction, Ohio, was promoted to succeed Mr. Byron, while J. S. Richards, assistant master mechanic at Akron, is advanced to succeed Mr. Bachman.

To meet the increased demand upon the company's engineering department, due to the $53,000,000 terminal improvements now under way in Philadelphia, several promotions have been made. An organization separate from the engineering division has been formed with Robert Farnham, former engineer of bridges, in charge of the entire terminal improvement work.

The company has announced the promotion of T. P. Watson of Pittsburgh, formerly assistant engineer of construction, central region, who will be Mr. Farnham's principal assistant. S. H. Noyes, formerly associated with the company's bridge department and recently in charge of bridge work for the city of Philadelphia, has been named assistant to the chief engineer, Philadelphia improvements. Both the latter positions were created as an aid to the speeding up of terminal improvements.

Other changes announced by the company include the promotion of B. M. Swope, master mechanic, Buffalo division, to be master mechanic at Columbus, Ohio, succeeding R. H. Flinn, recently promoted to superintendent of motive power, Northern division. D. K. Case, assistant master mechanic, middle division, succeeds Mr. Swope. The changes became effective March first.

Cincinnati-Bickford Enters Suit

Suit for infringement of several United States patents and upon a trademark, and for unfair competition, has been brought in the United States District Court, Southern District of New York, Eastern Division, by the Cincinnati Bickford Tool Co. against Morey & Co., operating as an importer of radial drills manufactured in Germany. The complaint alleges that the foreign-made machine infringes patents held by the plaintiff and also that the trade name "Bickford" is being wrongly used.

Business Items

Plans for rebuilding the Scott Machine Works, Veedersburg, Ind., recently destroyed by fire, have been announced.

The Michigan Central Railroad has announced the removal of its highest executive traffic office from Chicago to Detroit, under the management of O. R. Bromley.

The Billings & Spencer Co., Hartford, Conn., is to have its financial structure reorganized, according to plans now under consideration by the bondholders and stockholders.

The Bijur Lubricating Corporation has removed its purchasing, service and factory departments to its new plant at Harris Ave. and Governor Pl., Long Island City. The sales and engineering departments will continue at 250 West 54th St., New York.

The General Machinery Corporation, of Boston, Mass., has been appointed sales representative in New England, with the exception of Connecticut, for the Oliver Instrument Co., of Adrian, Mich.; also for the gear hobbing machines handled by Schuchardt & Schutte, of New York.

The Meriden Machine Tool Company plant at Meriden, Conn., is to be sold and the company liquidated. H. Wales Lines, recently deceased, was president. Henry Dryhurst was elected to fill the vacancy. John Johnston of Pawtucket, R. I. resigned as director and Norman L. Peck was elected director. Operations in the plant have been suspended.

Articles of incorporation have been filed with the secretary of state in Indianapolis by the Quick Welding and Machine Co., of Terre Haute, Ind. The company has an authorized capital stock of $20,000 and will do a general machine and tool business in addition to maintaining a repair department. The incorporators are Carl F. Maeller, Orville C. Coppage, Herman W. Maeller and Otto P. Kirschner.

The Chicago Pneumatic Tool Co. is now marketing a new line of Benz Diesel engines from 80 to 240 hp. The rights for manufacturing the Motoren Werke Manheim Benz solid injection Diesel engine were acquired by the Chicago Pneumatic Tool Co. some time ago. Since the war the design of Benz engines has been developed and improved, adapting them to industrial purposes.

The Oliver Machinery Co., of Grand Rapids, Mich., has been appointed exclusive agent and distributor for the semi-auto wood miller manufactured by Wadkin & Co., of Leicester, England. The Wadkin pattern milling machine was sold by the Oliver Machinery Co. in pre-war years. The agency was disrupted just prior to the war and no machines were imported for a long time. The machine has been redesigned and the Oliver company has again taken on this agency.

The Whiting Corporation of Harvey, Ill., has made the following changes in its sales organization: R. H. Bourne, formerly vice-president and sales manager, is now senior vice-president and will devote his time to the Grindle Fuel Equipment Co., and the Joseph Harrington Co. sales. N. S. Lawrence, formerly vice-president and assistant sales manager, is now vice-president and sales manager in charge of sales for the Whiting Corporation and the Swenson Evaporator Co. lines. Mr. Lawrence will be assisted by A. H. McDougall, vice-president and consulting engineer, R. E. Prussing, vice-president in charge of district offices and agents.

Accomplishments of the year were reviewed by officers of the Link-Belt Co., at a dinner on Feb. 18 marking the second annual "round-up" of salesmen and department heads. One hundred and sixty representatives of the company attended. Charles Piez of Chicago, chairman of the board of directors, was the principal speaker. Other speakers were: C. A. Gayman of San Francisco, president of the Pacific Coast unit of the Link-Belt; G. M. Moorhead, general manager of the Philadelphia plant; J. S. Watson, manager of the Dodge Link-Belt plant in Indianapolis; and F. S. O'Neil, manager of the Ewart Belmont Link-Belt plant.

Personals

E. W. Buschman has resigned as sales manager of the Foster Machine Co., of Elkhart, Ind.

W. E. Kerrish has been appointed advertising manager of the Boston Gear Works, Norfolk Downs, Mass.

Guy H. Wright has been named receiver for the St. Louis Reaming Tool Co., of St. Louis.

B. B. Fehr has been appointed director of the laboratory for the Copland Gear Lapping Syndicate, Detroit.

Walter Rautenstrauch has been elected president of the Splitdorf-Bethlehem Electrical Co. He was formerly president of the Fred F. French Co.

Thomas Eyre, formerly dean of engineering at the University of New Mexico, has been appointed professor of mechanical engineering at the University of Southern California.

John H. French, president of the Briggs Manufacturing Co., and Walter O. Briggs, chairman of the board, have purchased the controlling interest in Le Baron, Inc., designers and builders of custom bodies.

Hiram Percy Maxim, president of the Maxim Silencer Co., Hartford, Conn., has returned from a trip to the Pacific Coast, where a distribution depot is to be established.

Albert R. Erskine, president of the Studebaker Corporation, of South Bend, Ind., was recently elected third vice-president of the Indiana Society of the Sons of the American Revolution.

William H. Allen, of 110 State St., Boston, Mass., has been appointed sales representative in the New England territory for the Earl Gear and Machine Co., of Philadelphia.

Robert A. McGill, after completing a course of training at the plant of the McGill Metal Co., has been transferred to the company's sales department with offices at 58 W. Washington Blvd., Chicago.

William H. Hart of the Hart & Cooley Manufacturing Company and Edward N. Stanley, president of the Savings Bank of New Britain, have been added to the directorate of the Fafnir Bearing Company, New Britain, Conn. Other directors were re-elected.

O. Carter Berry, chief engineer of the Wheeler-Schebler Carburetor Co., of Indianapolis, has become chief of the engine division of the Buick Motor Co., Flint, Mich. He has been with the Indianapolis company six years, coming from Detroit where he was connected with the Hupmobile company.

Robert C. Lanphier has been elected president of the Sangamo Electric Co., Springfield, Ill., to succeed the late Jacob Bunn, who had been president of the company since its foundation in 1899. Mr. Lanphier has been vice-president and general manager for the past ten years. He is also president of the Sangamo Electric Co. of Canada, Ltd., and director of the British Sangamo Co., Ltd. Otis White, general superintendent, was elected vice-president in charge of manufacturing. Fred C. Holtz, chief engineer of the company, was elected vice-president in charge of engineering.

Obituaries

Fred M. Sharp, assistant works manager of the Oakland Motor Car Co., died in Pontiac, Mich., on Feb. 20.

Fred D. Taylor, vice-president and treasurer of the Sigourney Tool Co., with which he was identified for forty-five years, died at his home in Hartford, Conn., recently.

J. F. Haworth, formerly superintendent of the Heald Machine Co., of Worcester, Mass., and recently associated with the General Electric Co., died at his home in Pittsfield, Mass., on Feb. 12. He was 44 years old.

Forthcoming Meetings

American Railway Association. Engineering Division, March 8 to 10, at Chicago; Mechanical Division, June 7 to 10, at Montreal; Purchases and Stores Division, date and place not yet announced. H. J. Forster, secretary, 30 Vesey St., New York City.

American Society of Mechanical Engineers. Regional meeting, Kansas City, Mo., April 4 to 6. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

American Society for Steel Treating. Spring sectional meeting, Milwaukee, Wis., May 19 and 20. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Semi-annual meeting, White Sulphur Springs, W. Va., May 23 to 26. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

National Foreign Trade Council. Fourteenth national foreign trade convention, Hotel Statler, Detroit, Mich., May 25, 26 and 27. O. K. Davis, secretary, India House, Hanover Square, New York.

Society of Industrial Engineers. Annual meeting, Hotel Stevens, Chicago, May 25, 26 and 27. George C. Dent, secretary, 608 S. Dearborn St., Chicago, Ill.

Society of Automotive Engineers. Summer meeting, French Lick Springs, Ind., May 25 to 28. C. E. Heywood, manager of meetings department, 29 W. 39th St., New York City.

National Association of Purchasing Agents. Annual meeting and "Informashow" at Grand Rapids, Mich., June 6 to 9. W. L. Chandler, secretary, Woolworth Bldg., New York City.

American Foundrymen's Association. Annual convention, Edgewater Beach, Chicago, June 6 to 10. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Supply and Machinery Distributors' Association. Twenty-second annual convention with the **Southern Supply and Machinery Dealers' Association,** and the **American Supply and Machinery Manufacturers' Association,** on board the steamship *Noronic.* Boat leaves Detroit, Mich., June 13 and returns there June 17. George A. Fernley, secretary, 505 Arch St., Philadelphia.

American Society for Testing Materials. Annual meeting at French Lick, Ind., June 20 to 24. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

American Railway Tool Foremen's Association. Fifteenth annual meeting, Hotel Sherman, Chicago, Aug. 31, Sept. 1 and 2. G. G. Macina, secretary, 11,402 Calumet Ave., Chicago.

American Society for Steel Treating. Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

Machine Tool Exhibit. Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

National Machine Tool Builders' Association. First exposition of machine tools, at the Public Auditorium, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, vice-president and general manager, the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, chairman of the exposition committee. Ernest F. DuBrul, general manager of the association, 826 Provident Bank Bldg., Cincinnati. Roberts Everett, manager of the exposition, 1328 Broadway, New York City.

The Weekly Price Guide

Rise and Fall of the Market

A DECIDED improvement in demand has developed during the last week, for pig-iron, steel structurals, and iron and steel used in pipe making. The impending coal strike is reflected in higher quotations for coke, while more active buying with higher prices, appears in hot-rolled steel strips, bands, and hoops. A firmer market is anticipated in tin plates and steel sheets. Current fluctuations in virgin metals leave the fabricated non-ferrous shop materials practically unaffected in the principal centers of distribution.

(All prices as of Feb. 25)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.39
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	18.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	28.17
Basic	21.76
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	23.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.76
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00@4.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.15@2.25	3.50	3.15	3.89
No. 12	2.20@2.30	3.55	3.20	3.94
No. 14	2.25@2.35	3.60	3.25	3.99
No. 16	2.35@2.45	3.70	3.35	4.09
Black				
Nos. 18 to 20	2.80@2.85	3.75	3.25	4.15
No. 22	2.95@3.00	3.90	3.40	4.30
No. 24	3.00@3.05	3.95	3.45	4.35
No. 26	3.10@3.15	4.05	3.55	4.45
No. 28	3.25@3.30	4.20	4.70	4.60
Galvanized				
No. 10	3.00@3.10	4.10	3.95	4.40
Nos. 12 to 14	3.10@3.20	4.20	4.05	4.50
No. 16	3.20@3.30	4.30	4.15	4.60
No. 18	3.35@3.45	4.45	4.30	4.75
No. 20	3.50@3.60	4.60	4.45	4.90
No. 22	3.55@3.65	4.65	4.50	4.95
No. 24	3.70@3.80	4.80	4.65	5.10
No. 26	3.95@4.05	5.05	4.90	5.35
No. 28	4.20@4.30	5.30	5.15	5.60

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
065"	16	.19	.20	.21	.22	.23	.25	.27
083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	4.50	6.00@7.50	4.65
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@½-in. thick.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.37½
Tin, 5-ton lots, New York			71 62½
Lead (up to carlots) E. St. Louis	7.30	New York	8.00
Zinc (up to carlots) E. St. Louis	6.82½	New York	7.75

	New York	Cleveland	Chicago
Antimony (Chinese) ton spot	16.25	19.50	16.25
Copper sheets, base	21.50	21.25	21.50
Copper wire, base	18.37½	18.50	14.75
Copper bars, base	21.12½	20.87½	21.12½
Copper tubing, base	23.50	23.75	23.50
Brass sheets, high, base	17.87½	17.62½	17.87½
Brass tubing, high, base	22.75	22.50	22.25
Brass rods, high, base	15.62½	15.37½	15.62½
Brass wire, high, base	18.37½	18.12½	18.37½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	26.00	27.00	26.02
Zinc sheets (casks)	13.00	12.30	11.36
Solder (½ and ½), (case lots)	42.12½	43.50	38½@42½
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			88.00
Commercial genuine, intermediate grade			61.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			13.25
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35.00 Electrolytic 39.00 Shot			36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.25 @11.50	10.25	10.50@11.00
Copper, heavy, and wire	10.50 @11.00	10.50	9.50@10.00
Copper, light, and bottoms	9.00 @ 9.50	9.00	8.50@ 9.00
Heavy lead	6.25 @ 6.50	6.25	5.75@ 6.25
Tea lead	4.50 @ 4.75	4.25	4.75@ 5.25
Brass, heavy, yellow	7.00 @ 7.25	7.00	6.50@ 7.00
Brass, heavy, red	9.00 @ 9.25	9.25	8.75@ 9.25
Brass, light	5.25 @ 5.50	5.50	5.75@ 6.25
No. 1 yellow rod turnings	7.25 @ 7.75	7.25	7.00@ 7.50
Zinc	4.00 @ 4.25	4.00	3.00@ 3.50

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	6.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.12	.12@ .17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.15
Sal soda, per 175 lb. keg	2.80	2.75	2.75
Roll sulphur, per lb	.04	.03½	.04
Linseed oil, per 7½-lb. gal., 5 bbl. lots	.84	.98	.85
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.55	.50	.50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	33	.35	29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb.	.1562½	.1587½	.1687½
Solder (½ and ½)	per lb.	4212½	4075	3975
Cotton waste	per lb.	.13@17½	13@.17½	.15@.22
Washers, cast iron (⅛ in.)	per 100 lb.	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.33	33	35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.13	$4.95	$5.13
Emery paper	10.71	9.15	10.71
Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag		.75	.75
Coke, prompt furnace, per net ton	Connellsville,		3.35@3.50
Coke, prompt foundry, per net ton	Connellsville,		4.00@5.00
White lead, dry or in oil,	100 lb. kegs	New York,	15.25
Red lead, dry	100 lb. kegs	New York,	15.25
Red lead, in oil	100 lb. kegs	New York,	16.75

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%

Nuts, semi-finished, ½x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ⅜-in. and larger.
Case hardened ½x¼-in., 6c. each, less 50%

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in to 4$\frac{1}{16}$-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all dia meters, 25c.; ⅝-in. dia., 35c.; ¾-in. dia., 75c; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Equipment Wanted

Conn., Hartford — Philbrick-Booth Co., 267 Homestead Ave.—foundry equipment including large electric traveling crane for proposed 2 story, 62 x 67 ft. foundry. Estimated cost $40,000.

Md., Baltimore—Baltimore & Ohio R.R. Co., Baltimore and Charles Sts., W. S. Galloway, Purch. Agt.—18 in. x 6 ft. engine lathe, 32 in. shaper, heavy duty guide grinder, internal grinder, cylinder head joint facing machine, magnetic surface grinder, 24 in. x 8 ft. engine lathe, bench drill press, 30 x 30 x 30 in. crank planer, 48 in. x 12 ft. engine lathe, 2½ in. forging machine, all foregoing for Cumberland Yard; 24 in. x 8 in. engine lathe, 32 in. x 8 ft. engine lathe, flanging machine, ½ to 3 in. pipe threading and cutting machine, cut-off saw and tube expanding machine, stock adjusting machine, heavy duty knee type milling machine, 12 x 36 in. universal cylindrical grinder, combination quartering and crank pin truing machine, for Glenwood Shop; three 20 in. sensitive drill presses, two 60 in. radial drills 12 x 36 in. magnetic surface grinder, 12 x 36 in. universal cylindrical grinder, power hack saw, radius grinder, three 16 in. x 6 ft. lathes, 24 in. shaper, 24 x 24 in. x 4 ft. crank planer, 1 to 6 in. pipe threading and cutting machine, 1 to 4 in. pipe threading and cutting machine and ½ to 2 in. pipe threading and cutting machine, cylinder head joint facing machine, 20 in. engine lathe, 2 to 6 in. electric butt welder, 7 ft. double head, rail drill, swivel heads, for Mt. Clare Shops.

Mass., New Bedford—Pelletier & Berube, 551 Belleville Rd.—miscellaneous tools and equipment for 2 story, repair and service garage on Purchase St. Estimated cost $100,000.

Mass., Revere (Boston P. O.) — F. T. Foley, 499 North Shore Rd.—miscellaneous tools and equipment for repair and service garage Devon St. Estimated cost $80,000.

Mass., Salem—S. Weinstein, 1 Austin Park, Cambridge—general equipment and repair tools for proposed 1 story 90 x 200 ft. repair and service garage on Salem St. $50,000.

Mass., Somerville (Boston P. O.) — B. Goldfine, 11 Beacon St., Boston — miscellaneous tools and equipment for proposed 1 story repair and service garage here. Estimated cost $50,000.

Mich., Detroit—Simplex Casing Machine Co., 2028 West Philadelphia Ave.—equipment for machine shop.

N. Y., Brooklyn — Mutual Electric & Hardware Mfg. Co., 28 Verandah Pl.—one heavy shear for No. 10 metal, one 48 in. brake for No. 10 metal, one 19 or 21 Bliss press, one 16 to 18 in. shaper.

N. Y., Buffalo—Dept. of Public Safety, F. X. Schwab, Comr., will receive bids until Mar. 10, for woodworking and shop machinery for garage and repair shop at 257 East Ferry St.

O., Columbus—Carl Van Horn Co., 3415 North High St.—complete equipment for automobile service station.

Tex., Laredo—Auto Supply Co., c/o R. W. Wilkes—drill press, puncher, bolt cutter, lathe, welding equipment, etc., for proposed 1 story, 110 x 165 ft. garage. Estimated cost $40,000.

Ont., Blind River—R. J. Davis Co.—complete equipment for proposed lath mill. Estimated cost $50,000.

Ont., Hamilton — H. A. Burrel, Chm. Works Comn.—machine shop equipment for proposed municipal machine shop.

Ont., Newmarket—Office Specialty Co., Ltd.—milling machine for manufacture office furniture.

Ont., Toronto—Commercial Fixture Co., 122 Adelaide St., W.—upright tumbling barrel for tumbling metal parts.

Ont., Toronto—Pyrene Mfg. Co., 1197 King St. W.—ball bearing buffing machine.

Ont., Wiarfton—Gilpin Bros.—dowel machine.

Que., Montreal—E. Michaud, 102 Lelrun St.—complete machinery and equipment for blacksmith shop.

India, Lahore—The Lahore Electric Supply Co., Ltd., McLeod Rd., Post Box 27—complete machinery and equipment for manufacture of 2, 2½, 3, 3½ and 4 in. hinges, to be made from brass and iron sheets, a.c. motors, 220/380/6,000 v., 50 cycles, 3 ph. current. Include general layout plan and full description of various items c.i.f. Karachi complete.

Opportunities for Future Business

Calif., Los Angeles — Morris Furniture Mfg. Co., 4433 South Alameda St., having plans prepared for the construction of 2 story, 50 x 185 ft. factory addition, 4433 South Alameda St. Estimated cost $75,000. Private plans.

Ill., Chicago—Central Mfg. Co., 28 South Dearborn St., awarded contract for the construction of a 1 story, 100 x 150 ft. factory at 1715-1725 West 38th St. Estimated cost $40,000. H. C. Kniseley & Co., 1912 South Western Ave., manufacturers of sheet metal goods, cornices, etc., lessee.

Ill., Granite City—Commonwealth Steel Co. will build 1 story, 100 x 600 ft. shop for finishing foundry cast locomotive beds. Work will be done by company forces. Private plans.

Ind., Indianapolis—Stutz Motor Car Co., 1002 North Capitol Ave., awarded contract for the construction of 2 story, 80 x 200 ft. garage, 20th and Meridan Sts. Estimated cost $150,000. Private plans.

Ind., Lafayette—Chicago, Indianapolis & Louisville R.R., 608 South Dearborn St., Chicago, Ill., will receive bids about March 7, for 1 story, 76 x 500 ft. locomotive repair shop, here. Estimated cost $300,000. A. S. Kent, 608 South Dearborn St., Chicago, Ill., Ch. Engr. Noted Jan. 27.

Kan., Atchison — F. W. Stein, c/o The Steinite Laboratories, manufacturers of radios, had preliminary plans prepared for the construction of a 3 story, 130 x 200 ft. plant at 10th and Commercial Sts. Estimated cost $175,000. Homer, Wyatt & Rhodes, 468 Bd. of Trade Bldg., Kansas City, Mo., Archts.

La., Hammond—Standard Box & Veneer Co., Inc., C. Weinberger, Pres., 800 United Fruit Bldg., New Orleans, will soon receive bids for the construction of box factory, here. Estimated cost $100,000. E. Welle, Whitney Annex, New Orleans, Archt.

Mass., Boston—Firestone Tire & Rubber Co., South Main St., Akron, O., plans the construction of a 1 story repair shop and service station at Brookline Ave. and Fullerton St. Estimated cost $50,000. Architect not selected.

Mass., Dorchester (Boston P. O.)—G. V. Watterdorf, 699 Columbia Rd., awarded contract for the construction of a 1 story repair and service garage at Columbia Rd. and Everett Sq. Estimated cost $60,000.

Mass., Newton—Stewart Marshall Realty Co., A. S. Stewart, 280 Center St., is receiving bids for the construction of 1 story, 100 x 170 ft. repair and service garage, at Walnut and Center Sts. Estimated cost $75,000. E. J. MacDonald, 77 Summer St., Boston, Engr. Private plans.

Mass., Rutland—Central New England Sanatorium having preliminary plans prepared for the construction of 2 story, woodworking shop, on Miles Rd. Bigelow, Kent & Willard Co., Park Sq. Bldg., Boston, archts.

Mass., Waltham (Boston P. O.)—J. L. Thompson Mfg. Co., J. L. Thompson, Pres., Roberts St., Boston, manufacturers of rivets, awarded contract for the construction of a 3 story, 50 x 125 ft. factory, here. Estimated cost $50,000.

Mo., St. Louis — Century Electric Co., 1806 Pine St., will build 1 story, 105 x 124 ft. box factory, Pine and 19th Sts. Estimated cost $50,000. Work will be done by separate contracts.

N. J., Hoboken—American Lead Pencil Co., 500 Willow Ave., awarded contract for the construction of a factory. Estimated cost $225,000.

N. Y., Birmingham—Prest-O-Lite Co., 30 East 42nd St., New York City, plans the construction of a plant for manufacture of acetylene welding apparatus, here. Estimated cost $75,000. Private plans.

N. Y., New York—T. Luce, Inc., c/o Parker & Shaffer, Archt. and Engr., 280 Madison Ave., will soon receive bids for the construction of 10 story, 100 x 125 ft. auto service and repair shop, at 533 West 57th St. Estimated cost $500,000.

N. Y., New York—Stewart Automobile School, 225 West 57th St., having plans prepared for the construction of service building, at 253-257 West 64th St. Estimate cost $200,000. J. M. Felson, 250 West 57th St., Archt.

N. Y., New York—The Tagra Holding Corp., c/o J. M. Felson, Archt., 250 West 57th St., will build 75 x 100 ft. auto service building at 229 West 66th St. Work will be done by separate contracts under architect's supervision.

O., Canton—Hal-Fur Motor Truck Co., 2022 Allen Ave. S. E., plans the construction of a 1 story, 60 x 200 ft. factory. Estimated cost $40,000. Noted Feb. 3.

O., Columbus—R. W. Schiff, 108½ North 3rd St., having plans prepared for the construction of 1 story, 78 x 150 ft. repair garage, 3415 North High St. Estimated cost $40,000. H. C. Holbrook, James Theatre Bldg., Archts.

O., Dayton—Dayton Hydraulic Co., Spfd. Pk., having plans prepared for the construction of 2 story, 58 x 198 ft. factory, Beckel St. Estimated cost $40,000. Hiel Smith & Co., Hunters Bank Bldg., Engrs. Vulcan Tool Co., 418 East 1st St., lessee.

Pa., Elkins Point (br. Phila.) — L. L. Miller, Real Estate Trust Bldg., will build 1 story, 80 x 200 ft. garage, here. Work will be done by separate contracts. A. B. Lacey, 1012 Walnut St., Phila., Archt.

R. I., Pawtucket—Pawtucket Times, C. O. Block, Pres., having plans prepared for the construction of 1 and 2 story repair shop and garage. Estimated cost $50,000. Monahan & Meikle, 255 Main St., Archts.

Tex., Kirbyville — Trout Lumber Co., plans the construction of a sawmill, 20,000 ft. daily capacity. Estimated cost $40,000.

B. C., Vancouver—Dominion Bridge Co., 626 Pender St., West Vancouver, will build fabricating shop for structural steel, False Creek, at Cooke and Crowe Sts. Estimated cost $200,000. Private plans. Noted Feb. 24.

Ont., Brockville—J. M. Miller, 364 Dorchester St., Montreal, Que., Archt., will soon receive bids for the construction of a factory for the manufacture of wire here, for E. J. Phillips Electric Works, Ltd., 579 De Gaske St., Montreal, Que. Estimated cost $60,000.

Ont., Toronto — Hobbs Storage Battery Corp., 302 Bay St., plans the construction storage battery factory, Fleet St. and Spadina Ave. Estimated cost $100,000 to $150,000. Engineer and architect not selected.